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The new Brooklyn Bridge terminals will cost $2,041,913 to complete, instead of the original estimate of $1,714,413. This increased cost is due to change of plans to accommodate elevated railway traffic and enhanced expenditures for real estate. The widening of the New York roadway was not contemplated in the original plans, and the location of the whole New York station has been moved further towards Brooklyn and the floor level is raised several feet, involving the reconstruction of the whole building. The report submitted at the last meeting of the bridge trustees divides the $1,352,199 already expended, as follows: New Brooklyn station, $120,000; car storage house and real estate, $746,000; reconstructing New York station, $140,000; New York roadway, $107,600; cable-driving plant, $192,277; railway and equipment, $321,327. The receipts for January were $103,358.54, which is $1,304.19 less than for January, 1894. During January last, 3,802,655 passengers were carried, and on Feb. 9, 224,500 people crossed the bridge, the largest number in its history. The blizzard weather caused a nearly total stoppage of ferry traffic and also of the use of the promenade by foot passengers.

The most serious railway accident of the week was a derailment on the Long Island R. R. near Far Rockaway, N. Y., Feb. 8. The head engine of a double-header train engaged in bucking snowdrifts ran into an open switch and was upset, the engineman and fireman being crushed to death under the engine.—On Feb. 8 a rear collision of passenger trains occurred on the Grand Trunk Ry. near Weston, Ont., in which one man was killed and three were injured. An eastbound express train from Chicago was stalled in a snowdrift in a deep cutting and was run into by a local train which had passed the rear flagman owing to the blinding snow. The wreck caught fire and one of the cars was burned.

The heavy snowstorms of last week in the Eastern states were the cause of several minor train accidents, and in several cases snow-shovelling gangs were run into by trains or snow plows. Traffic was much delayed throughout New York State.

A rear collision of electric cars occurred on the elevated railway in Kansas City, Kan., Feb. 5 and several persons were more or less injured.

A locomotive boiler explosion occurred Feb. 6 on the Norfolk & Western R. R. The engine was pulling a train onto the side track at Curve, Va., when the crownsheet collapsed and the engine was blown into the air. The engineman and fireman were killed.

The engines of the French steamer "La Gascogne" broke down on her latest voyage to New York, and the vessel arrived, under her own steam, seven days after her proper date. The engine has six cylinders arranged in three tandem pairs, the 42-in. high-pressure cylinder being over the 79-in. low-pressure cylinder, and two 42-in. intermediate cylinders on top of two 79-in. intermediate cylinders. All the cylinders are of 42 ins. stroke, and the high and low-pressure cylinders form the middle pair, having one piston rod with two pistons. The ship sailed Jan. 27, and on Jan. 29 the middle piston rod broke between the two piston heads, where repairs could not be made. This necessitated considerable work in order to isolate the middle pair of cylinders, so as to work the two pairs of intermediate cylinders, and there was considerable trouble later from the heating of the crankshaft bearings, owing, perhaps, to a slight bending of the shaft at the time of the accident and to the bad distribution of strains under the new arrangement of working. As a result the engines could only be run at slow speed, and the vessel made from 66 to 280 knots per day, arriving off Sandy Hook Feb. 11. The heavy storms encountered blew the ship off her course and out of the regular steamer routes, so that she was not seen by any other steamer.

The New York Rapid Transit Commission was advised at its meeting on Feb. 12 that any material change in the route or the plan of construction adopted by the old commission will make necessary obtaining anew the consents of the property-holders, or in lieu of that, the consent of the Supreme Court, as required by the law.

The serious derailment accident on the Terre Haute & Indianapolis R. R. at Coatsville, Ind., Jan. 28, recorded in our issue of Jan. 31, was caused, as we are informed by Mr. N. K. Elliott, General Superintendent, by a broken switch rail, weighing 70 lbs. per yd., and less than two years old.

The Jeddo drainage tunnel, near Hazleton, Pa., is now completed. In 1887 the Harleigh, Ebervale and Jeddo coal mines were flooded by a swollen creek breaking into a "cave-hole" connecting with these valuable mines. It was estimated that it would cost $1,000,000 to pump them out, and they were abandoned until some other means could be found for draining them. In 1890 Mr. J. R. Markle, a prominent coal operator of Jeddo, conceived the idea of driving a tunnel 5 miles under the mountain, and thus tapping the lowest point of this coal basin. Mining Engineer Thomas McNair drew up the plans and the Jeddo Tunnel Co. was formed, including the owners of the abandoned mines. The outlet of the tunnel was to be in Butler Valley, 17,008 ft. from the end of the main driftway, and another tunnel, 9,888 ft. long, was to connect the Markle mines. The whole tunnel was thus to be 5⅛ miles long and the estimated cost was $1,000,000. Work was commenced early in 1891 under Charles F. King & Co., as contractors. Two shafts were sunk to the tunnel level and work was pushed until on Sept. 5, 1894, the headings met. A 12-in. drill hole was then bored from the surface, through the flooded workings and into the tunnel 450 ft. below. This hole diminished to 4 ins. at the tunnel roof and the iron pipe that encased the hole was finally plugged. In a short time the pipe and this plug will be removed and the 500,000,000 gallons of water in the mines will be run off. The difficulty with the farmers along Butler Valley, who objected to the mine water being let into the stream, has been adjusted by permitting this water to escape slowly.

Snow removal from the streets of New York is being effected on novel and more efficient lines than of old, by Col Waring, the new Commissioner of Street Cleaning. Chief among the innovations noted, the following may be mentioned: The attack of the snow even before it has ceased falling by a department force of 1,300 men and a reserve force of 2,500 men; 500 carts taking away the snow at once to the dumping points; the cleaning of all parts of the city, instead of only looking after the principal streets, leaving other sections untouched for days; and finally, the employment of vigorous young men, who work with a vim and are evidently under efficient control and have but one duty to perform—and that is, to work. The general sense of the New York press, without regard to politics, is that such prompt and comprehensive raising of a snow blockade has never before occurred in the history of the city of New York. The simple explanation is that a businesslike Mayor has appointed Col. Waring to clean streets and not to play "politics," and as a consequence the Commissioner can very forcibly impress upon his employees that he hires them for the work they can perform, and not for the votes they can cast, or influence.

A ship canal to connect the great lakes, the St. Lawrence and the Hudson River, is proposed in a bill soon to be presented to Congress, incorporating the Maritime Canal Co. of North America, with a capital stock of $10,000,000 in $10 shares, while the company may have an interest-bearing debt of $200,000,000. The government may at any time assume possession of the canals and works by giving the company one week's notice and paying for them a sum to be fixed by three arbitrators. A charter has already been obtained in Canada. Among the incorporators are John Bogart, M. Am. Soc. C. E.; Chauncey N. Dutton, Gustave Lindenthal, M. Am. Soc. C. E.; Thomas A. McIntyre, Henry B. Slaven, Geo. H. Stover and Smith M. Weed, all of New York; Samuel W. Allerton, D. H. Burnham, L. T. Fisher and O. D. Witherell, of Chicago, Ill.; T. C. Keefer, M. Am. Soc C. E., of Ottawa, Canada; G. G. Hartley, T. W. Hugo and Luther Mendenhall, of Duluth, Minn.; Wm. B. Dean and P. H. Kelly, of St. Paul, Minn.; L. R. Hurd and R. J. Wemyss, of West Superior, Wis.; Luther Allen, of Cleveland, O.; James Andrews, of Pittsburg, Pa.; F. L. Vance, of Milwaukee, Wis., and H. G. Burleigh, of Whitehall, N. Y.

An outcome of the Queen Lane reservoir controversy, in Philadelphia, is the trial for libel of Mr. W. T. Andrews, a contractor and unsuccessful bidder for the work. Andrews preferred charges of fraud against the powerful firm of city contractors who built the reservoir; he was unable to support these charges, and is now sentenced to pay $1,000 fine, and was ordered detained in prison until the fine was paid. Chas. T. Porter, of the firm that completed the reservoir, is one of the political leaders of Philadelphia.

The Washington aqueduct tunnel, condemned as unfit for any use by a board of experts in 1880, is to be tested as to the actual amount of leakage, under a $25,000 appropriation granted by the Senate to the District of Columbia. General Casey, Chief of Engineers, recommended this test some years ago, and he argues that, while he expects the tunnel to leak, the pressure due to the original head will prevent the entrance of surface water and the contamination of the supply, and he believes that this leakage will gradually decrease as the fissures fill up with the material deposited from a silt-bearing water. It is now proposed to fill the tunnel and to test the amount of this leakage; if it should then appear safe to complete the tunnel, General Casey estimates the cost of doing so will be $600,000, of which sum $362,027 is now available.

The stand-pipe of the water-works at Anthony, Kan., is reported to have been wrecked in a recent high wind. According to the "Manual of American Water-Works," the stand-pipe had a capacity of 150,000 gallons, and was erected about seven years ago, at the time the water-works were constructed.

The U. S. government astronomer, Prof. Simon Newcomb, has completed the tabulation of the elements and masses of the major planets, from Mercury to Saturn, inclusive. This recalculation and tabulation, which will be of great value to astronomers, was made necessary by the unreliability of previous theories and tables as proven by the more exact work of modern astronomy. Some doubt yet exists in the case of Mars; the mathematical theory of the motion of this planet being exceedingly difficult, and satisfactory tables will require still further work. The government observers have been materially assisted in this task by Prof. Elkin, of Yale; Dr. Auwers, of Berlin, and by Dr. Gill, the English astronomer.

The Massachusetts State Board of Health, after a detailed investigation extending over some months, has recommended that 28 cities and towns, including and surrounding Boston, and having in 1890 a combined population of 840,012, be formed by legislative enactment into a metropolitan water district. The Board recommends that three commissioners be appointed by the governor to develop a supply from the Nashua River above Clinton and convey it to the various municipalities. A 63,000,000,000-gallon reservoir is proposed, and the works are estimated to cost about $19,000,000. A bill appropriating this sum for the above purpose and providing for the appointment of a commission has been introduced in the legislature, the commissioners to begin work May 6, 1895, the chairman to have a salary of $5,000 and the other two members a salary of $3,000 a year. The proposed supply would furnish 111,000,000 gallons a day in dry years, which, with the 62,000,000 gallons, alone, of the present Boston supply from the Sudbury River, would give 173,000,000 gallons a day, or double the supply from the sources now utilized by the various towns and cities within the limits of the proposed district. The reservoir could be connected with the present Sudbury system and additions to the supply could easily be made.

The Cotton States and International Exposition to be held at Atlanta, Ga., from September to December, will have for fire protection the equipments for three hose companies, three steam fire engines, two two-horse chemical engines, and one hook and ladder truck. In the principal buildings will be eight fire-extinguishing machines of 60 gallons capacity, carried on two wheels, and about 300 extinguishers of three gallons capacity. There will be a complete equipment of the Gamewell fire-alarm system, with the latest improvement in the form of an auxiliary alarm. This auxiliary alarm includes boxes with electric push buttons placed at different parts of the building, the boxes having glass fronts. When any one button is pushed an annunciator in the fire engine station shows the location of the alarm.

THE ILLINOIS & MISSISSIPPI CANAL LOCK WORKS.

(With Inset.)

The Illinois & Mississippi Canal is designed as a cut-off, or a short route, from the Upper Mississippi River to Lake Michigan, in connection with the present existing water routes. In 1848 the Illinois and Michigan Canal was completed, giving a water way from the Chicago River at Bridgeport to the Illinois River at La Salle, Ill., 97 miles long. From La Salle to the Mississippi River at the mouth of the Illinois River the distance is 223 miles, while from La Salle to the Mississippi River in about a straight line west to the mouth of the Rock River, is not over 75 miles, through a comparatively level country, abounding in small rivers, creeks, and swamps. Obviously, if a canal were built to the mouth of the Rock River, many advantages would be gained to the flourishing towns of the Upper Mississippi, while towns as far down the river as Quincy would find an appreciable reduction in the distance by water to Chicago.

To follow the various movements of the Federal and State Governments to secure this short-cut canal would take much space and be of little general interest. In 1888, however, Congress passed an act authorizing the Secretary of War to locate a canal from near the town of Hennepin, on the Illinois River, to the mouth of the Rock River, to be called the Illinois & Mississippi Canal. The act also stipulated that the canal should be 80 ft. wide at the surface of the water and 7 ft. deep, and should have locks 30 ft. wide and 170 ft. long. Although several more or less complete surveys had been made for such a canal previous to 1888, it is since that date that most of the work toward a practical end has been done, for it was seen in the beginning that while the surveys of 1882 and 1885 gave sufficient information upon which to base preliminary estimates, they could not be depended upon for use in making the final working plans.

Accordingly, after the passage of the act referred to above by Congress, new surveys were begun under the command of Capt. W. L. Marshall, U. S. Engineer Corps. The first surveys made were: (1) a line from the Illinois River to the summit level; (2) the rapids at the mouth of the Rock River, and (3) the district in the vicinity of the head of the feeder. From these surveys and the old surveys, plans and estimates were prepared and submitted to Congress in 1890. Since then the surveys have been continued, and at present the location of the eastern section has been completed from the Illinois River to the feeder junction, 25 miles, and eight miles of the right of way have been secured and the contracts let. Surveys have also been completed from the feeder junction to the junction of the Rock and Green rivers, but no location has been made. Of course, although the entire line has not been definitely decided upon, the general route of the canal has been pretty well settled. This is shown in the accompanying map, Fig. 1.

Briefly described, the line of the Illinois & Mississippi Canal is from a point near the town of Hennepin at the great bend of the Illinois River, via the valleys of Bureau, Pond, and Cow Catcher creeks, to the summit level at the 20th mile, ascending 205 ft., through 24 locks, with lifts ranging from 3 ft. to 10 ft. each. From the summit level the route is to the junction of the feeder at the 25th mile, thence to the Rock River at Penney's Slough at the 30th mile, thence down Rock River to its mouth, 27 miles. The length of the western slope from the feeder junction to the Mississippi River is 52 miles, and of the main line of the canal 77 miles, of which 50 miles are canal and 27 miles slackwater navigation down the Rock River by means of locks and dams. The dimensions of the canal are, as previously stated, 80 ft. wide at the water level and 7 ft. deep. It was decided, however, to increase the width of the locks to 35 ft., and to build them of concrete instead of stone masonry. The banks of the canal are to have slopes of 3 to 2, and where the canal is formed by parallel levees in the river, the slopes are to be riprapped, and in case it is necessary the trunk of the canal lined with 6 ins. of Portland cement concrete to make it water-tight.

To supply water to the summit level, a feeder was surveyed to connect with the Rock River near the town of Dixon, Ill. The length of this feeder is 34¾ miles, and it is proposed to construct it [illegible] the same dimensions as the main canal, making [illegible] navigable. Its estimated cost is nearly $1,900,0[illegible] and it has been questioned whether it is in all [illegible] spects the best solution of the problem for whic[illegible] it was devised. In the report of the Chief [illegible] Engineers for 1890, Capt. Marshall says:

> The long feeder to Dixon is expensive, although by making it navigable it adds materially to the value of the canal and makes the extension of the navigation of Rock River towards its headwaters by slackwater possibly even to Green Bay, via Lake Huricon and Fox River, more probable than without it. Still it is doubtful whether the feeder is necessary as the only or least expensive plan to supply the summit level, for by cutting it down deeper, Green River and the Winnebago swamp may be drawn upon and may furnish a sufficient supply to the summit level for many years, or until the capacity of the canal is approximately reached.

It is entirely possible, therefore, that this long feeder may be abandoned before construction reaches the summit level, and some other source of supply selected.

From the profile in Fig. 1, it will be seen that the rise to the summit level in the east end is made in the first 20 miles and requires 24 locks, while the fall to the Mississippi River on the west is made by 13 locks. There are thus 37 lift locks on the canal, besides the guard lock at the head of the rapids of the Rock River. The profile also shows the location of the aqueducts and the railway crossings. In addition to these there are numerous highway crossings and culverts underneath the canal for the passage of small streams. These culverts, when of greater capacity than a 48-in. pipe, are built of concrete, as is all of the masonry work, including bridge abutments, sluices, retaining walls, etc. The various constructions on the feeder will be similar in all respects to those

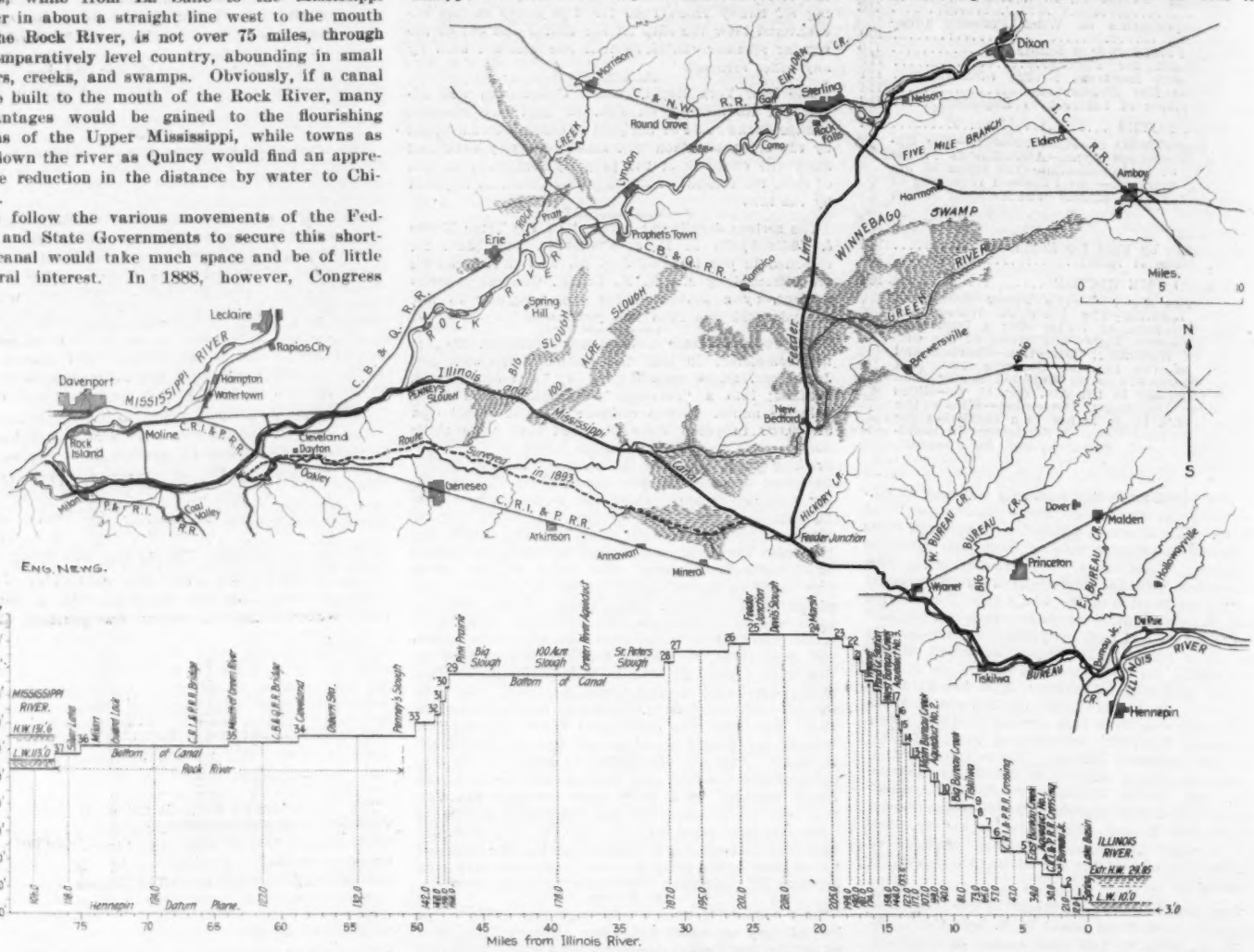


FIG. 1. MAP AND PROFILE OF ILLINOIS & MISSISSIPPI CANAL.

on the main canal. There will be only one lock, however, namely, a guard lock at the mouth of the feeder.

The first work was begun in July, 1892, on the 4½ miles of canal passing the rapids of the Rock River. This work required two dams across the river, one near the mouth and the other at the head of the rapids; 4½ miles of trunk canal, 4,000 ft. of which were formed by parallel levees in the river bed; one guard lock, two lift locks, Nos. 36 and 37, and the necessary culverts, sluices, etc. Within the last few months the contracts have been let for the first eight miles of the canal west from the Illinois River. The most interesting feature of the work is the lock masonry, which, as has already been stated, is entirely of concrete. For the purpose of illustrating this work we shall take, first, the guard lock at the head of the rapids; and, second, lock No. 36, like which in all respects the other lift locks are to be built.

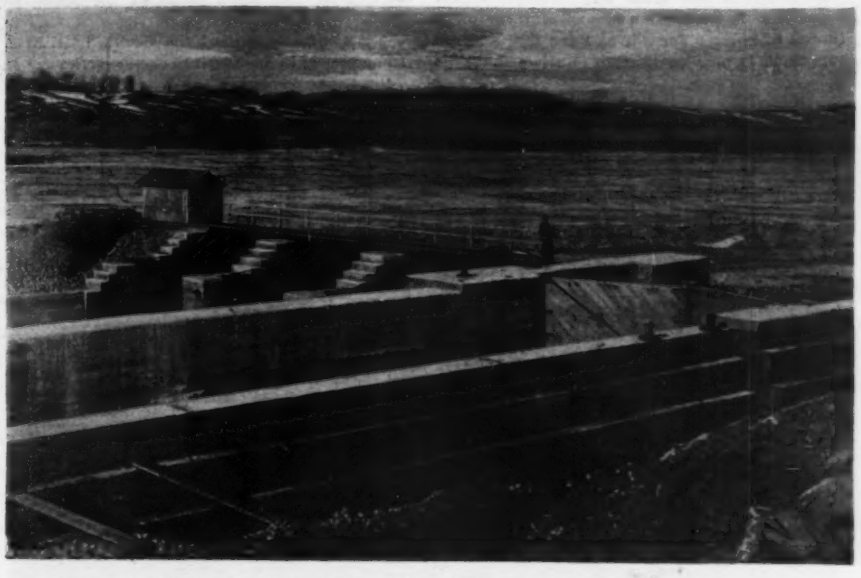


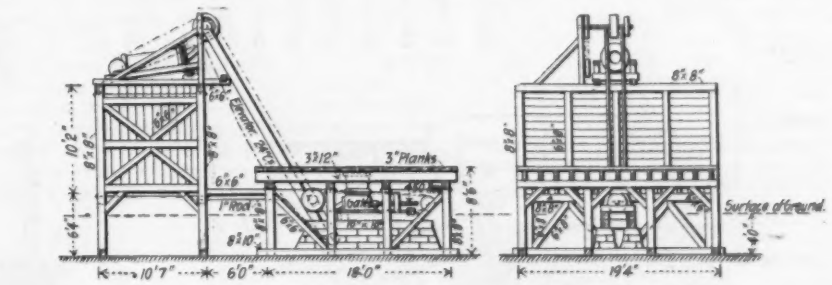
FIG. 2. VIEW OF GUARD LOCK SHOWING LOCATION OF TAINTOR GATES.

The general design and construction of the guard lock is shown on the inset sheet. The work consists of the lock proper, a culvert about 150 ft. long and 10 ft. × 6 ft. 9 ins. inside, three Taintor gates closing the sluices, and several retaining walls. The object of this lock is, of course, to regulate the admission of water into the canal from the pool above the dam at the head of the rapids. The sluices and gates are for the purpose of passing the water into the canal. The accompanying view of the guard lock (Fig. 2) from a photograph will aid in understanding the location of the sluices and gates. This view also gives a good idea of the appearance of the concrete masonry. The various dimensions of the lock are given on the drawings and need no further explanation.

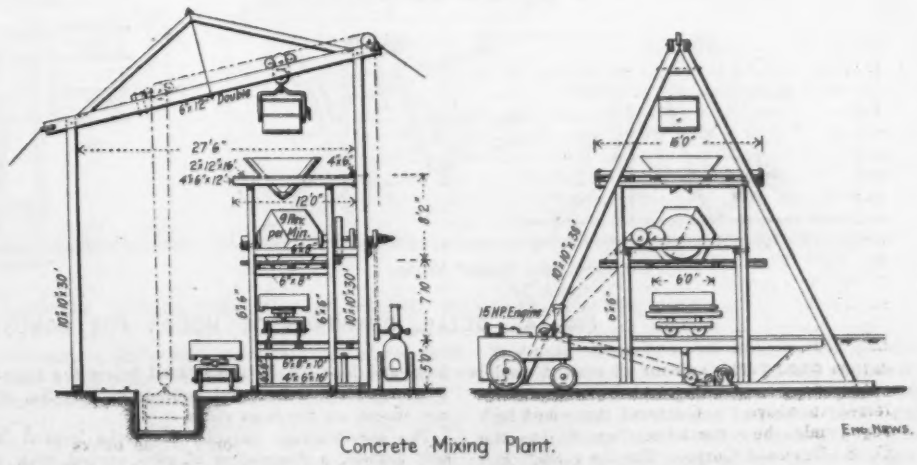
In constructing such large masses of masonry entirely of concrete it was necessary, of course, to devise special methods for handling the material. Three brands of German Portland cement were used, but by far the largest part of the concrete was made from Alsen's Yellow Label brand, 99% of which passed a 2,500-mesh sieve, and 87% a 10,000-mesh sieve. The initial set of this cement took place in from 22 to 30 minutes. All the concrete was mixed by machinery, and from 5 to 10 barrels of cement were dumped at one time into the cement box to insure a better mixing of the cement itself. At lock 36, 3,535.8 cu. yds. of concrete were laid, at the average rate of 86.2 cu. yds. per day of eight hours. This was not the capacity of the machinery, but it was as fast as the concrete could be properly leveled and tamped in the forms.

It was thought at first that sufficient pebbles would be obtained from the canal excavation in the vicinity, but this was not done, and broken stone had to be used. This stone was broken by a Gates crusher and conveyed to bins by a belt bucket conveyor for storage, as shown in Fig. 3. The sand, pebbles, and broken stone were conveyed by dump cars to a charging box with a capacity of 45 cu. ft., set in the ground, and dumped in with the cement and water. The charging box was then lifted by a device shown in the drawings (Fig 3) and carried over the cubical mixer into which the load was dumped. This mixer had a capacity of 4 cu. ft., and was run by a 15-HP. engine at nine revolutions per minute. When thoroughly mixed, the concrete was dumped into the tram car running underneath the mixer and conveyed to the work, where it was placed in the forms or molds.

The extended use of concrete in the construction of this work is one of its especial features, and the practice here followed may tend to materially reduce the cost of many works located at points where stone suitable for masonry cannot be found. In this case the stone on the line of the canal was unsuitable for masonry, being seamed and shattered in every direction, and having no defined plans of cleavage. By careful sorting stone was found adapted to crushing; and subsequent experiment has brought out the fact, "beyond any doubt," that this impure limestone, when finely crushed and screened and used to dilute cement, gave stronger results than crushed quartz, or crushed marble.



Crushing Plant and Bins.



Concrete Mixing Plant.

FIG. 3. STONE CRUSHING AND CONCRETE MIXING MACHINERY.

The manner of constructing the molds is shown in Fig. 4, and also by the accompanying view (Fig. 5), from a photograph. A strong timber framing, thoroughly braced, was first built to conform to the general shape of the mold desired, and then this was lined with planks, carefully smoothed where a smooth masonry face was desired, as on the faces of the lock walls. Pine timber was used altogether. As will be noticed, the drawings show molds for the culvert as well as the lock walls of the guard lock, and also molds for the side and miter walls of lock No. 37. These drawings show the details of construction very clearly.

In constructing the side walls, and, in fact, all of the concrete work, great care was taken to have the laying of the concrete continuous, so that one layer might not become set, or partly set, before the next was added to it. By this it was expected to secure perfect monolithic construction, with no lines of weakness at the junction of the different layers. To do this in the long side walls, vertical partitions were placed in the molds at intervals, dividing the wall into sections, which were finished one at a time. Different mixtures of concrete were used for the facing and backing, but they were laid simultaneously. The backing was composed of 1 part cement, 2½ parts sand, and 5 parts broken stone, or if pebbles were used they took the place of 1 part of the broken stone. For the facing a mortar of 1 part cement and 2 parts sand was used. The facing was 8 ins. thick, and a coping 5 ins. thick was also made of the same mortar. The rule followed was to use as much water in the concrete as was possible, and yet not have it quake under thorough ramming. To insure sufficient moisture to the concrete during its hardening, 12 × 12-in. wells were sunk at points along the center line of the wall and filled with water. These wells were afterward filled with concrete. The total amount of concrete used in the

guard lock, sluices, etc., was 3,762 cu. yds., and the cost of laying it was as follows:

5,246 bbls. Portland cement	$15,603.82
152 bbls. Utica cement	83.60
2,901 cu. yds. broken stone	1,709.15
1,970 cu. yds. sand	1,396.41
128 cu. yds. pebbles	113.30
Lumber for forms	2,635.90
Labor building forms, etc.	2,726.72
Labor mixing and placing concrete	6,693.02
Miscellaneous bills	416.72
Total	$32,122.24

The cost of the concrete work per cubic yard was thus $8.54. The amount of cement used per cubic yard of concrete was 1.4 bbls.

As stated before, at one side of the guard lock there is a sluiceway for letting water into the canal which is closed by three Taintor gates. The construction and operation of these gates are shown in Fig. 6. They are each 21 ft. wide and 13 ft. high. Their upstream faces are cylindrical, the radius of the circle being 12 ft. 3 ins., with the center 6 ft. above the center of the horizontal trunnions upon which the gates revolve. The gates are hoisted by means of a hoisting carriage running on a track on the bridge extending over the gates. It may be stated that a set of four Taintor gates is also placed further down the canal to let the water out into a neighboring slough.

In addition to the lock just described and another guard lock at the mouth of the feeder for the summit level, the canal will have 37 lift locks, all of which will have the same dimensions and be constructed in the same way, except in the minor details. A description of one of these locks will therefore answer for all, and for this purpose No. 36, which is now completed, is selected. This lock and lock No. 37 are located below the guard lock. A plan and several sections of lock No. 36 are shown on the inset sheet.

The specifications provide, for locks located in soft ground, a foundation of piles capped with a timber and concrete grillage. These specifications were prepared on the assumption that the foundations should carry the lock walls and the weight of the chamber full of water, but that the pressure of a possible hydrostatic head tending to force the floor upwards should be prevented by thoroughly subdraining the foundations and the rear of the lock walls into the lower level. To do this, two rows of 1½-in. tongued and grooved sheet piles are driven at the head and tail bays, as shown in the general plan. These sheet piles are driven 8 ft. below the bottom of the foundation and their tops are firmly joined together and sawed off so as to extend up 6 ins. into the concrete. The location of the drains for lock No. 36 is shown in the drawings. As will be seen, 9-in. tile drains, beginning below the sheet piling of the upper bay, extend, one along the rear of the lock wall and the other along the foot of the foundations, to a 12-in. tile cross-drain leading into the lower level. In some of the other locks, or wherever it is necessary, drains will also be placed underneath the foundation. It will be seen that this is practically an application of the principle of weep holes often constructed in retaining walls to get rid of the fluid pressure.

The piles used in the foundations were of hard wood and were driven 16 ft. into the soil, or until the blow of a 2,000-lb. hammer falling 10 ft. produced a penetration of only ½ in. After being sawed off, the piles were capped with 10 × 10-in. longitudinal pine timbers, fastened with drift bolts. These longitudinals were capped by 6 × 10-in. and 10 × 10-in. transverse timbers, also fastened by drift bolts, and all space between and around the timbers

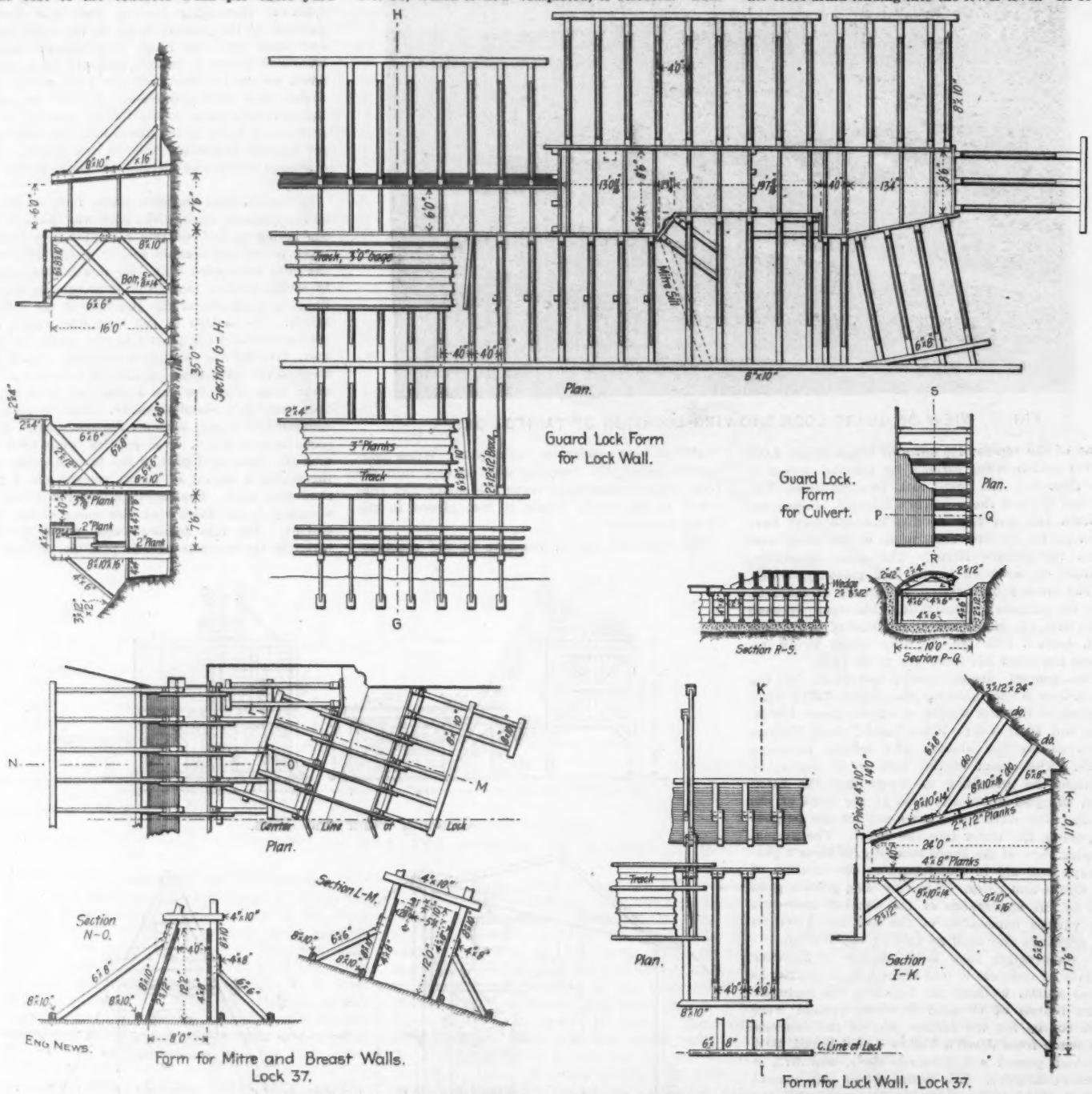


FIG. 4. DETAIL DRAWINGS OF MOLDS FOR CONCRETE MASONRY.

was thoroughly filled with concrete, rammed with 30-lb. rammers, in 4-in. layers. On top of the foundations was spiked a floor of 2-in. plank.

For lock 36 the foundation concrete, except under the lower gates, consisted of 1 part Utica natural cement, 1 part sand, and 3 parts screened pebbles, while that under the lower gates consisted of 1 part Germania Portland cement, 2 parts sand, and 4½ parts screened pebbles. The Utica cement cost, delivered at Milan, Ill., near the work, 55 cts. per barrel, and the Germania cost $3.10 per barrel. The contract price for this work was $5 per cu. yd., the government furnishing the cement. Utica cement concrete, consisting of 1 part cement and 3 parts gravel was used for lock 37. Here the government did the work by day labor and the mixing, depositing and ramming cost $1 per cu. yd. At both locks the material was hauled upon the foundations in wagons and the ingredients mixed by hand, and shoveled directly into place.

The lock walls and all other masonry are of concrete. The lock walls are 4 ft. wide at the top and are vertical on the chamber side and with a batter at the back. Both the coping and the face, to depths of 8 ins. and 5 ins., respectively, were made of 1 cement to 2 sand mortar, mixed by hand, instead of concrete. For building the walls, timber molds were constructed, as already described and illustrated, and the rules followed in mixing and depositing the material were, in all respects, exactly the same as in constructing the guard lock.

The total amount of concrete used in lock No. 36 was 2,146 cu. yds., 1,819.2 cu. yds. of which were in the main walls. These 1,819.2 cu. yds. of concrete were mixed and deposited in seven 24-hour days, or at the rate of 86.6 cu. yds. per eight-hour day. All work was done by day labor, under the supervision of the government engineers. The work was carried on night and day until the wall was completed. The proportions of the concrete were 1 part cement, 3 parts gravel and 4 parts broken stone, and the cost was as follows:

3,010 bbls. Portland cement	$9,057.45
1,252 cu. yds. broken stone	1,922.95
851 cu. yds. gravel	664.17
500 cu. yds. sand	888.61
Lumber for forms, etc.	281.65
Labor for building forms	1,472.09
Labor mixing and depositing concrete	3,897.19
Miscellaneous bills	253.36
Total	$18,436.77

The cost of concrete per cubic yard was thus $8.61. One cubic yard of concrete required 1.4 bbls. of cement. In lock No. 37 the total amount of concrete was 3,767 cu. yds., and the cost per cubic yard $9.16. The total amount of concrete used at the three locks and at the sluice gates, dam abutments and foundations of locks 36 and 37,—these last amounts being 855 cu. yds. for lock 36 and 1,074 cu. yds. for lock 37 and not included in the figures given above—was 12,402 cu. yds. Some interesting facts regarding this concrete work are taken from a paper by Mr. J. W. Woermann, U. S. Assistant Engineer, published in the "Journal of the Association of Engineering Societies," for November. Omitting the natural cement concrete foundation work in locks 36 and 37, Mr. Woermann states that the percentage of the total cost which each element of the concrete construction constituted is shown by the following table:

	Abutments. Per cent.	Guard lock. Per cent.	Sluice gates. Per cent.	Lock 37. Per cent.	Lock 36. Per cent.
Cement	46	49	48	42	47
Stone	17	10	07	14	10
Pebbles	05	00	03	05	03
Sand	02	04	05	04	05
Lumber and iron	04	02	04	03	03
Carpenter work	09	09	09	08	08
Mixing and placing concrete	12	21	21	18	20
Plant	03	02	01	02	03
Miscell. items	02	03	02	04	01

FIG. 5. VIEW OF MOLD FOR LOCK WALL IN POSITION.

For this class of concrete work performed under similar conditions the total cost will be, according to these figures, distributed approximately as follows: Cement, 45%; other ingredients, 20%; lumber and iron, 3%; carpenter work, 9%; mixing and depositing concrete, 18%; plant and miscellaneous items, 5%. The average cost per cubic yard of the facing in place was $16, as compared with $8.25 for the concrete proper. The weight per cubic foot for the concrete as determined from 6-in. cubes made from regular mixings at lock 36 was 148 lbs. for concrete proper and 133½ lbs. for the facing. The percentage of water absorbed during four days' immersion was 2.1% and 3.4%, respectively. The sand used was ordinary river sand, not sharp, but possessing a considerable range in the size of its grains. In the dam abutments, where the mixing was done by hand and the work isolated, the cost of the concrete was $12.24 per cu.yd.

Water is admitted to lock 36 from the upper level by culverts in the lock walls passing around to the rear of the hollow quoins, and is allowed to escape to the lower level through valves in the lower gates. In the guard lock both upper and lower gates are provided with valves, as is also the case in some of the other locks where the lift is slight. Details of the gates for lock No. 36 are shown on the inset sheet.

The canal itself was simple levee and excavation work, from 4 to 5 ft. deep in earth and about as much in rock. On the 4th and 5th miles, 37,750 cu. yds. of earth were moved by scrapers and placed directly in the bank at a total cost of $5,110.47, or an average of 13½ cts. per cu. yd. About 6,660 cu. yds. of gravel, loose rock, sand and mud were also excavated at an average cost of 59 cts. per cu. yd. The earth for the river embankments was loaded into rotary dump-cars, by means of scrapers passing over a trap, at an average cost of 17 cts. per cu. yd. for 86,432 cu. yds. The 25,914 cu. yds. of rock excavated by drilling and blasting, and including loading in cars, cost 86½ cts. per cu. yd. The transportation of the earth and riprap for the river embankments, over a haul ranging from 2,000 to 8,000 lin. ft., and including 128,092 cu. yds., cost an average of 5⅞ cts. per cu. yd. The unloading and placing of this same material in the embankments cost 7 cts. per yd. This work was done by contract by John D. Lynch, of Monmouth, Ill.; but all the concrete work before described was done with hired labor.

Beyond the description already given, the illustrations show very clearly the details of construction of the locks. For the matter from which our illustrations and the accompanying description have been prepared, we are indebted to Capt. W. L. Marshall, Engineer Corps, U. S. A., who has charge of the construction of the Illinois & Mississippi Canal, and we have also obtained some further detail from the report of U. S. Asst. Engineer L. L. Wheeler, in charge of this work under Captain Marshall.

Water was first let in to the section of the canal described above on Nov. 29, 1894. The large sluice gates worked admirably, as they can be raised any distance required, being partially balanced by having the center of curvature a short distance above the center of motion, as above described and shown on the drawings.

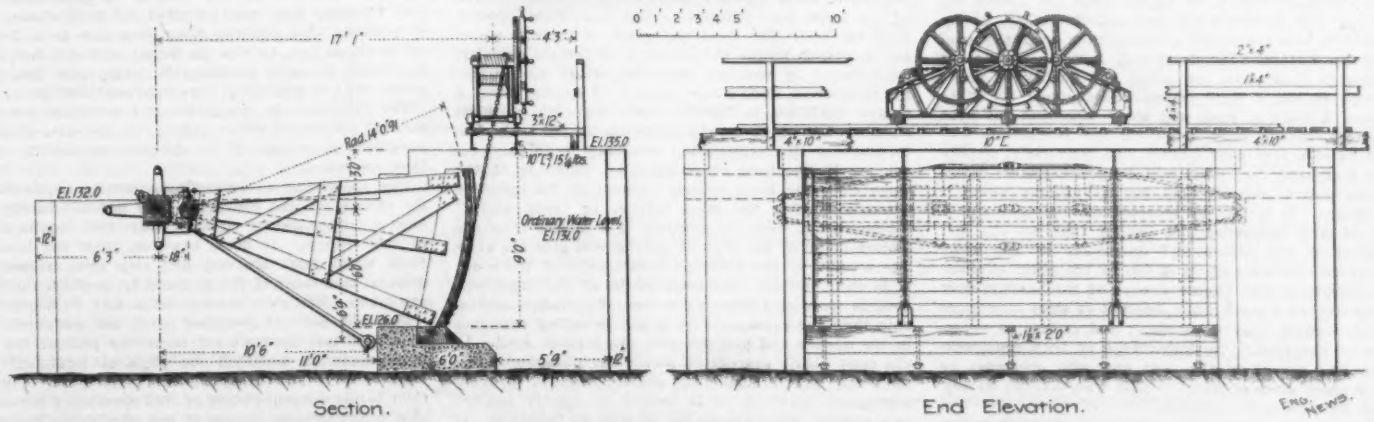


FIG. 6. DETAILS OF TAINTOR GATES CONTROLLING SLUICEWAYS IN GUARD LOCKS.

SPECIFICATIONS FOR STRUCTURAL STEEL.*

The chief defect of almost all modern specifications for structural steel lies in the fact that properties only are specified and not quality. By the properties of steel we mean those physical or chemical characteristics which can be definitely determined by the testing machine, the blacksmith's hammer, or by chemical analysis. By quality we mean that condition of internal structure which is indicated by the presence or absence of blow-holes, sponginess, etc., and by the degree of homogeneity of the metal. The properties of steel are absolute; its quality, comparative. By its properties we are able to determine the strength of the pieces upon which we make experiments and their suitability for the use to which we intend to put the metal. By its quality we can judge whether all the rest of the steel, upon which experiments have not been and cannot be made, is likely to prove equally as strong and suitable as the selected samples and to endure for any length of time the work which we intend to impose upon it. The chemical composition of steel is an important function of both its properties and its quality. Without a sound constitution to start with, no steel can be reliable. Skillful manipulation may conceal to some extent the symptoms of a bad constitution, but cannot effect a cure. The method of manufacture and the processes used in furnace work, have an important bearing upon the quality of steel and comparatively little effect upon its properties. Rolling mill manipulation may affect quality, as by unskillful heat treatment a constitution originally good may be weakened or destroyed, but the process of rolling in itself does not affect the quality of steel, though it has a very decided effect upon its properties. A piece of steel may show excellent ultimate strength, elastic limit, reduction and elongation, and still be of a very poor quality, and conversely, quality of a high order may exist with properties which would render a steel entirely unfit for the use for which it is desired. It is only by securing the requisite standard of both properties and quality that we can feel assured of the safety and endurance of any steel structure. To the neglect of one or the other of these considerations (but almost always of the quality) may be attributed a good many failures of steel structures which seemed most mysterious; and failure to recognize or understand the importance of both considerations has caused in the past and still continues to cause many users of metal to look with distrust on any steel for structural purposes.

Most specifications for structûral steel prescribe physical tests alone, it being erroneously assumed that metal which in test pieces shows good physical results must be reliable and lasting. A very few specifications recognize the importance of quality, but these specifications are confined to steel of definite and special kinds. It is believed that the accompanying specifications are the first wherein quality, as distinct from and independent of properties, is recognized and provided for in all kinds of steel adapted to all structural purposes.

The physical requirements in these specifications are purposely made more moderate than in many others. The possibilities of steel-making are well known, and it is useless to make specifications outside of them. Very high specified limits for physical tests do not always bring any better steel, but only make it necessary to carefully select the places from which the test pieces are cut in order to get the desired results. Sometimes, especially if these limits are not well "balanced" among themselves, they are a temptation to the manufacturer to put special treatment on the test pieces. They lead the purchaser, too, to a false sense of security in his structure, giving him the idea that the whole of the metal is of the character which the steelmaker sometimes knows is only possessed by selected or possibly specially-treated test pieces. It is believed to be better to specify such physical limits as the poorest part of a piece of steel should show, and which can be obtained without undue expense or extraordinary manipulation by any skillful maker. And this, of course, carries the inference that the purchaser or his inspector possesses sufficient knowledge of steel-making to select his samples for testing from the places which will give the poorest results. The strength of a structure, like that of a chain, is the strength of its weakest link; and there would seem to be little use in making experiments on the strongest links while we do not know what the weakest one will bear. Some specifications are in use wherein the limits are so fixed that it is absolutely necessary to carefully select the best places in order to get results fulfilling the requirements, because steel cannot be made whose worst parts will satisfy the conditions.

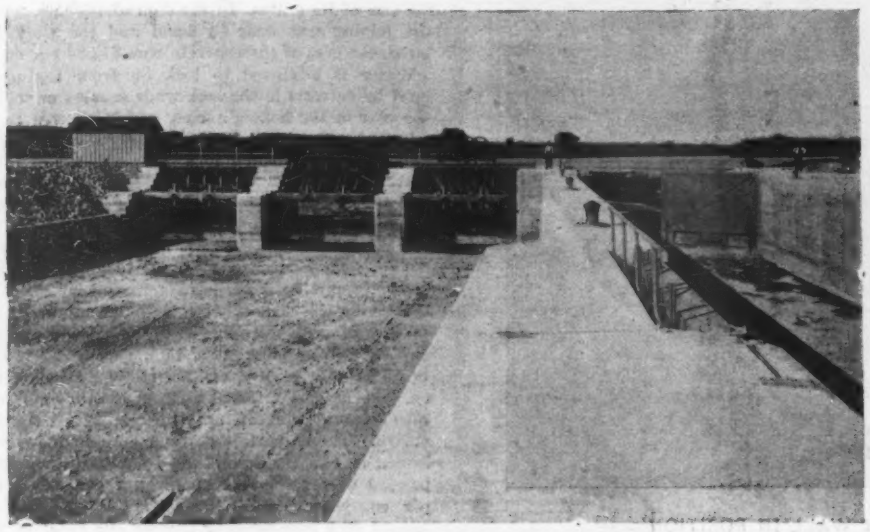


FIG. 7. VIEW OF GUARD LOCK, SHOWING CENTRAL GATE RAISED.

There are natural phenomena incident to the manufacture of steel which tend to make certain portions of the ingot (and the steel rolled therefrom) poorer than the rest. The most important of these is segregation—which means the tendency of certain chemical constituents to separate from the others and gather by themselves during the process of cooling from a molten condition, so that in a solid ingot the chemical elements are by no means uniformly distributed. Unfortunately the segregating tendency is highly developed in the case of phosphorus, which is at the same time the most intense element in its influence towards making the steel brittle, or "cold short." Consequently, while an analysis of a sample from the molten metal at the time of casting will give the average amount of the different constituents of the steel, it is quite certain that some parts of the ingot will contain more and some parts less of certain constituents than the average, with a corresponding variation in the quality and properties of the finished steel. At the most highly segregated points the phosphorus element may exist in double the amount found in the least segregated portions. It is useless to specify against this natural phenomenon and unwise to ignore it. It is better to recognize it and provide for it, as is done in these specifications, setting such limits as will not be impracticable or too onerous for the manufacturer on the one hand, or will allow segregation to become dangerously excessive on the other. By having an inspector of sufficient skill to select the most highly segregated spots for an analysis, the purchaser can be absolutely sure of knowing the worst possible conditions existing in his steel on account of segregation.

The selection of a grade of steel for any work should be governed by the conditions of shop manufacture and the intended use of the structure into which the steel is to be put. In general, the softer the steel, the more abuse it will stand without dangerously affecting its properties. The abuse to which steel is subjected is of two kinds—legitimate and illegitimate. Legitimate abuse consists of the shearing, punching, straightening, bending and distorting, either hot or cold, with or without subsequent annealing, to which the steel is necessarily subjected in the mills and shops during manufacture. Illegitimate abuse is the drifting of poorly-matched holes, the gouging of blind holes, the cutting off hot of surplus material which should be removed by machining, the "stretching" of material which is too short, the over-heating of rivets, eye-bar heads and other forgings, and the thousand and one other things used as "short cuts" to an end, or by workmen to cover up their blunders.

As the harder steels are approached, the abuse must be curtailed or remedied. For legitimate abuses, well reamed or drilled holes are substituted for punched holes; sheared edges are planed off, material bent hot or cold is thoroughly annealed; forgings are worked at a lower heat and carefully kept from sudden cooling. The illegitimate abuses should be prevented, as far as possible, by thorough and competent supervision, and the imposition of severe penalties when detected. The combination of a soft grade with a good quality will produce the most satisfactory results in general practice.

The variation in ultimate strength for all grades, except the extremes, has been made 10,000 lbs. In the extreme grades, softness in one case and hardness in the other are the main considerations, and, therefore, but one limit has been imposed.

The variations in ultimate strength imposed in specifications, within reasonable limits, are purely a matter of individual taste. The variation most commonly allowed is 8,000 lbs., but numerous exceptions to this may be found in which the variations range from 4,000 lbs. to 14,000 lbs. The specification for hull material used by the U. S. Navy has only one limit for ultimate strength—a lower one—and under this specification have been made large quantities of most excellent materials.

The ultimate strength of steel depends fundamentally upon the percentage of elements contained—the principal hardener being carbon. With these as a base, the ultimate strength may be increased or diminished from normal conditions by varying the heat treatment and manner and amount of work. The specifying of narrow limits for ultimate strength, in order to secure a uniform steel, may therefore result in securing a metal that is decidedly non-uniform in other respects.

The elongations and reductions of area are moderate for each grade, and should be readily met by standard tests cut from any part of the material, provided it has received proper heat treatment and work. For test pieces cut in the ordinary manner—namely, from the most favorable locations—these specified results will be exceeded.

For the softer grades the reduction is numerically twice the elongation, and for the higher grades it becomes less. These ratios are in accordance with the nature of the material.

When ordinary thicknesses are exceeded, the finishing temperature and amount of work are no longer normal, and the greater the variation in thickness the greater will be the consequent variation in elongation and reduction due to these causes. A reasonable limited variation has been provided for these cases. In exceedingly thin material there may also be a falling off in elongation, as also in forged material, but it is impossible to make provision for every case that may arise, and the generality have been provided for.

The difference in elongation and reduction between sheared plates and other material of the same grade is provided, on account of the different manner in which they are rolled.

The specifying of exceedingly severe requirements for elongation and reduction does not necessarily secure a better quality of steel than fair requirements in this respect. It does, however, limit the location from which tests are cut, and may even necessitate unusual treatment of the material from which the tests are taken. The gain, consequently, may be negative.

The cold, hot and quenched bends are moderate, and should be met by tests cut from any part of the finished material, provided the physical treatment has been correct, and the chemical composition is good. Cold bends develop excess of cold shortening elements. Hot bends develop excess of hot shortening elements. Quenched bends develop excess of hardening elements otherwise concealed by hot finishing or annealing.

Elastic limits are sometimes left out of steel specification altogether; in other cases the elastic limit is required to be a certain percentage of the ultimate strength, and the most common case of all is where a certain fixed minimum elastic limit is specified. The fixed elastic limit is probably a survival of the adaptation of iron specifications to steel during its early use in structural work. The variable elastic limit is entirely logical, but not more so than its omission, unless certain definite objects are in view, which it is not desired to provide for in a perfectly definite manner.

The elastic limit herein provided for of one-half the ultimate strength is a safe minimum limit for all kinds, grades and qualities of well-worked steel. In steel castings, which are not worked at all, and in large sections which only receive work enough to bring them

*From "Explanatory Notes in Connection with General Specifications for Structural Steel," by A. C. Cunningham, M. Am. Soc. C. E., issued by the American Engineering & Inspection Association, Albany, N. Y.

to form, the elastic limit will sometimes be found to be somewhat less than one-half the ultimate strength.

Elastic limits, as ordinarily determined in testing machines, are in reality the "breaking down" points of the test specimens, and are beyond the point of true elastic limit. The elastic limit is reached when a material receives sufficient stress to distort it beyond recovery to its original form. There may be several such points in steel, and some investigators claim that every stress, however slight, produces a "permanent set" in steel. When steel has received a sufficient stress to destroy all of its elasticity, so that each additional increment of stress which is applied, whether great or small, increases the distortion, the final elastic limit has been passed, and the material is no longer fit for use.

The finished condition is the point at which the user takes up the steel, and it is, therefore, from the finished material that the tests should be taken. Preliminary tests are a guide to the manufacturer and an aid in securing certain definite results in the finished material.

The location, size and shape of test pieces, as used in general practice, are a sufficiently accurate guide to the physical properties of steel as far as they can be demonstrated by ordinary tests. When common practice shows that the steel is not as specified, it is possible, by varying the conditions of location, size and shape, to make it appear otherwise than it really is. Varying the condition of tests by annealing or other special treatment, also gives misleading results, as such tests do not represent the finished condition of the steel.

The appearance of the fracture of a tension test is a valuable guide to the condition of the steel. In the ordinary grades of structural steel which have received good heat treatment and work, the appearance known as "silky" occurs, which somewhat resembles in color that of a broken slate pencil. The form is described as "angular" or "cup," or may be a combination of the two forms, and is caused by the rupture of the test pieces in the planes of shear, which are developed under stress. As the harder grades of steel are approached, the fracture has a tendency towards fine granulation, and ultimately takes a fine granular form, also called "silky," and occurs in a plane at right angles to the axis of the test piece.

Coarse granular or crystalline fractures may indicate too high or too long heating. Coarse, irregular and open fractures, having an appearance like coke (described as "coky") may indicate insufficient work. Abnormal conditions of fracture are generally accompanied by abnormal conditions of elongation and reduction. When an abnormal fracture occurs, it should first be ascertained whether it is not due to improper or insufficient machining of the test piece, local flaws or injurious local treatment.

Under eye-bar tests provision has been made for the natural fall in ultimate strength due to the size of test piece and softening from annealing. The elongation has been specified in 20 ft. as being sufficient to show the quality of the bar in this respect, and to avoid needless complications when bars of small section and unusual length are tested.

The requirements of full-sized tests have been made few and of a general nature, as, in justice to those who make the heads and finish the bars, the grades and quality of the steel used should be definitely determined before any work is done on the bars. Those who finish the bars are responsible for the workmanship on the heads and the heat treatment of the material while in their charge. If the grade and quality are unquestionable to start with, improper workmanship and heat treatment will cause the failure of the test bars under the specified requirements, and no question can arise as to the cause of the failure or the responsibility therefor.

Frequent complications and rejections arise from the widely varying results of specimen and full-sized tests from the same steel. These are readily understood when it is considered that large amounts of material are frequently accepted on the results of a single specimen test selected from the most favorable location, and in no sense representative of the average condition of the material. This specimen test is followed by one or more full-sized tests, which may represent the worst condition of the material, and which, if they break in the body, do represent the average condition of the cross-section. Failure of the heads of eye-bars is generally credited to bad workmanship, but they are quite as likely to be due to inferior steel at the place of rupture.

The discrepancies between specimen and full-sized eye-bar tests in ultimate strength are sometimes remedied by annealing the specimen tests. This is not necessary when a sufficient range of variation has been allowed in the first place, and is objectionable for the following reasons. Annealing a specimen test not only lowers the ultimate strength, but increases the elongation and reduction, and improves the appearance of the fracture; consequently steel which might be objectionable in its ordinary condition, may be accepted after annealing, and the question is always open as to whether the full-sized bars have been annealed under the same conditions, and with the same care and attention as the annealed specimens. If we know that our steel was originally acceptable, we may be certain that if properly annealed it is still good. If we do not know what its original condition was, we have no positive assurance that the full-sized bars are not inferior to the annealed specimen tests which we may have made.

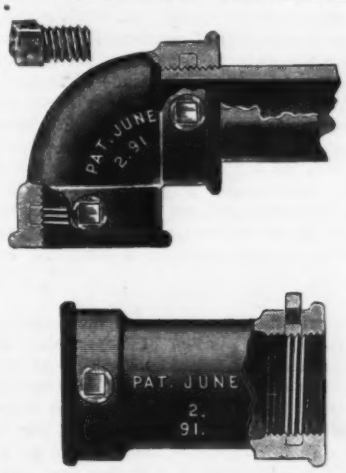
Where a sufficient range in ultimate strength has been provided, and steel is unquestionable as to grade and quality, unannealed specimen tests will prove satisfactory, and there will be few rejections of full-sized test bars.

In these specifications the existing conditions of manufacture have been taken into account, and they have been so framed that the user may readily provide for any grade or quality of steel desired. Difficult, unusual and excessive requirements have been omitted, as they are of little practical value to the user, are difficult to enforce, and are often the cause of annoying and serious delays to the manufacturer. Some of the supposed tests that are required of steel are in reality easy, and such specified requirements would be readily passed by steel of very common quality.

TIGHT JOINTS FOR PIPE FITTINGS.

The many demands in these days of high pressures for pipe fittings that will not leak or that can be easily made tight when changed conditions cause leaks are obvious to all. Such fittings are now made in practically all shapes by the Tight Joint Co., of New York city. The method employed is shown by the accompanying illustration and the following brief description:

In making these fittings a groove is cast or sunk in their threaded portion, and filled with lead. The



Pipe Coupling and Elbow with Compressible Lead Packing Ring.

lead is formed upon a threaded mandrel of slightly smaller size than the fitting, so that the lead projects a very little beyond the threads. A small hole, with a thread cut upon it, is made through the fitting, into the lead-filled r cess, and a small set screw inserted, or a number of screws, distributed around the circumference, if the size of the pipe demands it. If now a pipe be screwed into the fitting, it will expand the leaden packing, causing it to tightly fill the screw threads, and if the joint is not made tight by this means, one or more turns of the compressing screws crowd the lead around the pipe and make it absolutely tight.

It will be seen that the lead under high pressure acts like a viscous fluid, and the small area acted on by the set screw exerts an enormous pressure on the lead ring, expanding it in every direction.

Extensive experiments made at the Stevens Institute of Technology, Hoboken, N. J., by Mr. D. J. Jacobus, Assistant Professor of Experimental Mechanics, showed remarkable resistance to leakage under high pressures. These tests are so interesting that we quote from Professor Jacobus' report as follows:

Four different patterns of the joint were received, two of which were of the form in which they are to be placed on the market, and two of special construction.

The two fittings that are the same as those that are to be placed in the market are ½ and ¾-in. brass tees, weighing 1 lb. 3 oz., and 9¾ oz., respectively. These are so constructed that the loss of strength due to the groove holding the lead ring is counteracted by rings cast on the outside of the fitting. The set screws to compress the lead are turned by a screwdriver.

The two special sets of fittings are made by turning out grooves in ordinary fittings in which to place the lead rings. The fittings were made in this way simply to demonstrate that the joint can be used at high pressures. One set is made from 1-in. brass hydraulic tees, and the other from 1-in. malleable iron ammonia tees. The set screws in these fittings are turned by a wrench. The weight of the iron tee with set screws in place is 1 lb. 15¾ oz., and of the brass hydraulic tee 4 lbs. 15¾ oz.

The lead rings in all the fittings are about ¼ in. wide, and extend about 3-16 in. below the top of the threads. The distance from the face of the fitting to the lead ring is about 3-16 in.

The tests consisted in submitting the joints to pressure, starting a leak and tightening up under the full pressure by turning down the set screws so as to compress the lead rings.

The following tests were made:

½-in. and ¾-in. brass tees.—Made to leak and tighten up at 300 lbs. per sq. in. steam pressure, 1,700 lbs. gas pressure, and 3,000 lbs. heavy refined petroleum oil pressure.

1-in. iron tee No. 1.—Made to leak and tightened up at 150 and 300 lbs. ammonia pressure, 150 and 300 lbs. steam pressure, and 10,000 lbs. heavy refined petroleum oil pressure. Withstood 12,700 lbs., at which point a crack or flaw caused a leak through the solid metal of the neck of the fitting. No leakage occurred at the joints at the final pressure.

1-in. iron tee No. 2.—Made to leak and tightened up at 5,000 and 10,000 lbs. crude petroleum oil pressure, and 5,000 to 10,000 lbs. water pressure. Withstood 15,000 lbs. crude oil pressure without leakage, and 16,000 lbs. per sq. in. water pressure.

The gas joints were placed under water, to make certain that there was no leakage after tightening up the set screws. To make certain that the ammonia joints were tight, they were gone over very carefully, and no odor was detected from them.

A leak was started at 15,000 lbs. water pressure, by unscrewing one of the plugs placed in the tee. The fitting burst at this pressure before the experiment was completed to determine if the leak could be stopped.

1-in. iron tee No. 3.—Leaked and tightened up at 8,000 lbs. water pressure, by employing a punch instead of the set screw. Withstood 17,800 lbs., at which pressure it began to swell outward to such an extent that it leaked at all the joints. On removing the pressure it was found that the metal had stretched so much that the plugs placed on the tee could each be advanced several turns. The lead rings had been forced outward by the pressure, and had thus prevented excessive leakage after the tee began to swell.

1-in. brass hydraulic tee No. 1.—Made to leak and tightened up at 1,000 and 2,000 lbs. water pressure. Ordinary cast iron plug burst out at about 5,000 lbs. per sq. in., injuring one of the threads. The tee was blown from the end of the testing pipe at 8,000 lbs. per sq. in. The cause of the last breakage was that the testing pipe did not project far enough into the fitting to extend beyond the lead ring.

1-in. brass hydraulic tee No. 2.—Made to leak and tightened up at 5,000 lbs. water pressure. At 10,000 lbs. the plugs in the tee began to bulge outward, and the portion of the tee surrounding the plugs began to swell. Only a slight leakage occurred at the joints. The test was discontinued at this point.

Other favorable tests are reported by the company as having been made at the Brooklyn Navy Yard and by the Mr. Chas. O'Connor, of the Standard Oil Co. These joints are now largely used by makers of refrigerating machinery, hydraulic pressure machinery, and compressed air machinery, and in distilleries, oil refineries, breweries, and many other industries where leaking pipe joints have heretofore been a constant source of trouble and waste.

A French engineer, M. Issartier, proposes to reach the summit of Mont Blanc by a combined railway, tunnel and vertical shaft. According to the plan set forth in "Le Genie Civil," he would ascend the mountain by railway to a point at an elevation of 1,800 m., in the Mirage ravine below Saint Gervais. He would then drive a tunnel, 24,272 ft. long, to a point directly under the summit of Mont Blanc, and reach this summit by a vertical shaft, 39.4 ft. square and 9,284 ft. deep. Tunnel driving and shaft-sinking seemingly present few obstacles to this engineer—in his estimates, at least. He claims that the work could be done in 12 years, at a cost of $1,800,000. In this 1.8-mile deep vertical shaft he would establish a lift of an "especial type." Easy access at all seasons to an observatory of astronomy and meteorology, to be established on top of the mountain, is mentioned as one of the advantages of the proposed enterprise.

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ADVERTISING RATES: 20 cents per line agate measure. Want notices, special rates, see page 23. Rates for standing advertisements sent on request. Changes of advertisements must be in hand on Monday afternoon; new advertisements, Tuesday afternoon; transient advertisements by Wednesday noon.

We give in this issue a resume of some recent investigations of the relation between pressure and suction when the wind acts upon bodies of various forms. The experiments appear to have been made with great care, and point to the necessity of taking into account the sheltered surface as well as the exposed surface, in considering the action of the wind upon a structure.

We show elsewhere, in this issue, drawings illustrating the work on the Illinois & Mississippi Canal. The work is especially notable by reason of the extent to which concrete has been employed in it, practically to the exclusion of ordinary masonry. So far as we now recall, these works exceed in magnitude any hydraulic works ever before constructed in concrete. The work has been done, moreover, at an exceedingly small cost, and reflects much credit upon the engineers who have carried it out.

The work is notable from another point of view as the first instance in which the national government has undertaken the construction of an ordinary barge canal of such a length. Any canal work done by the government heretofore has been practically confined to the improvement of navigable rivers, and the construction of a long canal across country is a new departure.

Whether this canal will ever secure traffic sufficient to warrant its construction is a question on which much difference of opinion exists. Its shallow depth, 7 ft., will prevent its use by any vessels larger than ordinary canal boats; and railway rates are now so low that if the interest on the cost of the canal enters into the account, such canals, it is pretty certain, cannot carry freight at as low rates as the railways. The Erie Canal is, perhaps, the best example of this. Although it is now a free public highway, the boatmen upon it are fast succumbing to railway competition and a smaller tonnage was moved over it last season than in any year since 1850.

On the other hand, with the completion of the Chicago drainage canal, and the improvement of the Illinois River, there may be considerable traffic through this new waterway. Whether there will ever be enough to justify its construction as a public work at public expense, is a matter on which opinions will probably differ, and the truth will only be known some years hence after the enterprise is carried to final completion.

In our correspondence column this week we publish a letter from Mr. John Thomson, M. Am. Soc. C. E., discussing further the proposed amendments to the Am. Soc. C. E. constitution, which were commented on editorially last week. Respecting Mr. Thomson's criticism, we would say that we do not disapprove of the open ballot, proposed by the amendment to Art. III., Sec. 5, of the constitution, but distinctly approve of any amendment which will render more difficult the use of "the sand-club of darkness" in voting upon any applicant for membership. The objection to the effect of the proposed amendment was chiefly based upon the supposition that the average vote cast was a larger one, and in this respect we yield to the more exact knowledge of our correspondent and admit that our comment loses a certain amount of its force accordingly. Though Mr. Thomson does not send his letter for publication, we submit it, so that our readers may know more of the intent of one of the committee framing the amendment, and act accordingly. But, with our correspondent, we believe that only good can result from calling the closer attention of members of the American Society of Civil Engineers to the responsibility imposed upon them in indorsing candidates for election. As Mr. Thomson says, the present blank, faithfully and honestly filled out, requires the sponsor to be "extremely careful"; but past practice has been very loose in this respect, and the evil effects of this old-time practice are apt to linger in the minds of members. Our intention was to strengthen the hands of the Board of Direction, in the matter of finally disposing of candidates rejected under a secret ballot; but without the conscientious co-operation of members in the matter of furnishing the data necessary for action, this intelligent disposition would be made extremely difficult. If the proposed amendment will aid in the work, because it would be still possible without it to obtain 30 to 35 negative ballots by improper means, then we say let it be passed. But there is all the more reason why members should only act from intimate personal knowledge and honest conviction in all matters relating to the original presentation of the name of a candidate to the Board.

Secretary Carlisle is considering the papers of 29 applicants for the position of Supervising Architect. Meanwhile, he is said to be so well pleased with the management of this office by Chief Clerk Kemper that he would like to make him Supervising Architect, the chief obstacle in the way being the fact that this executive officer is not an architect. In this connection, it is further said that Mr. Kemper, made "chief executive officer" at a salary exceeding that allowed by law, is a close friend of Logan Carlisle, son of the Secretary and Chief Clerk of the Treasury. The personal influence of this latter official may explain the secret opposition to the McKaig bill for reorganizing this bureau, which Congressman Bankhead refuses to present for a vote, though the majority of Congressmen seem to favor its passage. With these rumors comes the appointment of a Special Committee of Congress to investigate the constant presence of foul air in the hall of the House. The committee has already discovered that the ventilators beneath the seats of members are always filled with all manner of refuse; that hundreds of tons of public documents are rotting in the basement of the building, and that vapors from the Turkish bath, adjoining the House kitchen, permeate the structure. While this condition of affairs in the Hall of Congress has directly to do with a special officer, the venerable architect of the Capitol, it is but another argument in favor of a most radical reorganization of all that has any connection with the present practice in maintaining as well as designing and erecting our public buildings. The whole system seems to be in the same condition as the objectionable documents in the basement of the House of Representatives.

A bill providing for the examination and licensing of land surveyors in Illinois has been brought before the Illinois legislature by a committee of the Illinois Society of Engineers and Surveyors. The bill provides for a state examining board, to be appointed by the Governor, which shall examine all candidates "as to their knowledge of the use and adjustment of the transit and leveling instruments, of the theory and practice of land surveying and leveling, and of so much of mathematics as may be required for such practice." Such candidates as successfully pass the examination will receive a commission entitling them "Illinois Land Surveyors," and licensing them to do work and certify it with such a title. A penalty is provided for the unauthorized use of the title.

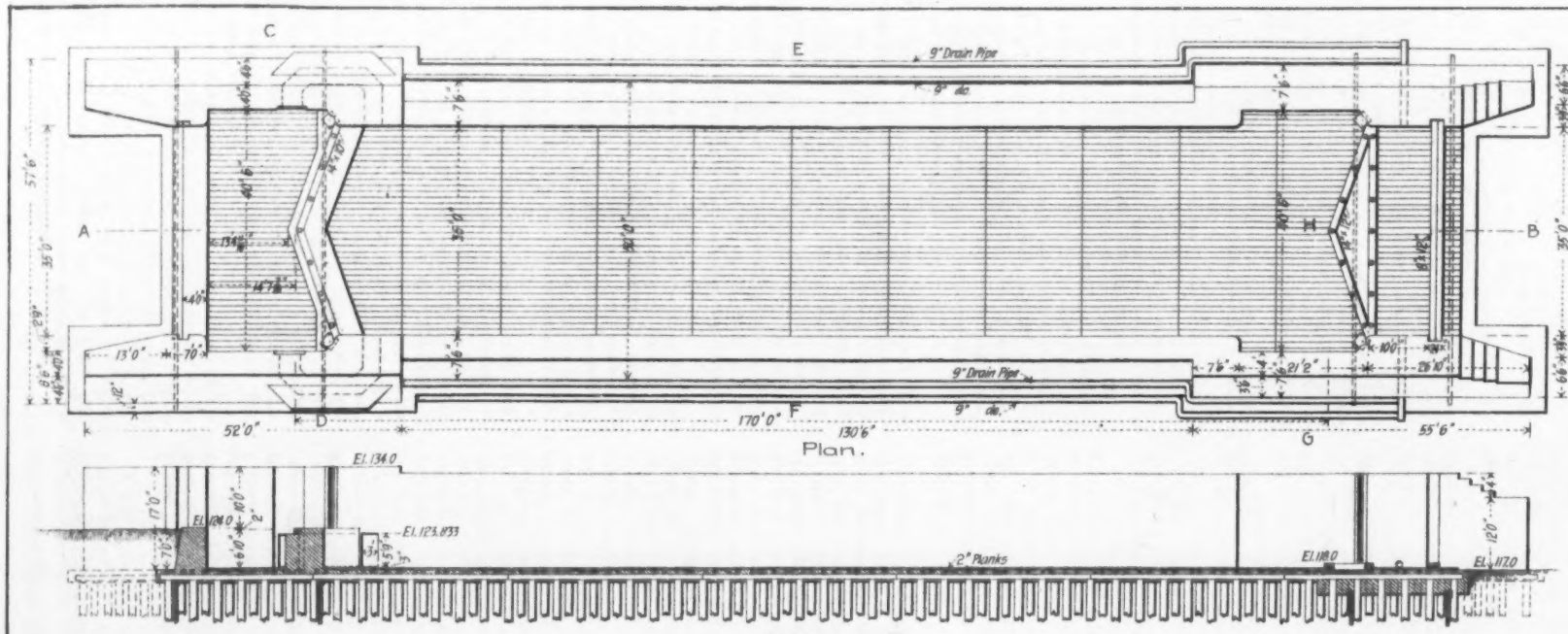
Whether this bill passes or not, it contains an important lesson to those who are working to transform various branches of engineering into "close" professions. It ought to be plain that any attempt to secure the passage of laws forbidding the practice of engineering, or any branch of it, except by those authorized by an examining board or commission, is pretty certainly destined to failure. On the other hand, if the compulsory feature of such proposed legislation is dropped, it may be possible to secure some legal authorization for the granting of certificates of competency by some organization now existing or to be created. If the examinations and the granting of such certificates were done by able and conscientious men, so that a real weeding out was effected and favoritism was excluded, it is certainly reasonable to hope that a large public benefit would accrue. At any rate, the experiment could be tried on this basis with little prospect of harm. Those who employ engineers would employ those with or those without certificates of competency, as they pleased; and if the system did not effect the desired result of putting into the positions of responsibility the men of greatest ability, it could readily be amended or abolished.

As we have before pointed out, there is a wide and rapidly strengthening opinion among engineers that some means of distinguishing the man who is really an engineer from the man who pretends to be and is not, is urgently needed. Whether this opinion is wise or foolish we shall not now discuss. There is something to be said on both sides of the question, or so many good men would not differ upon it. What we do wish to point out is that it is the course of wisdom, if any measure of reform is to be effected, not to attempt the impossible; but to start the wedge thin end first.

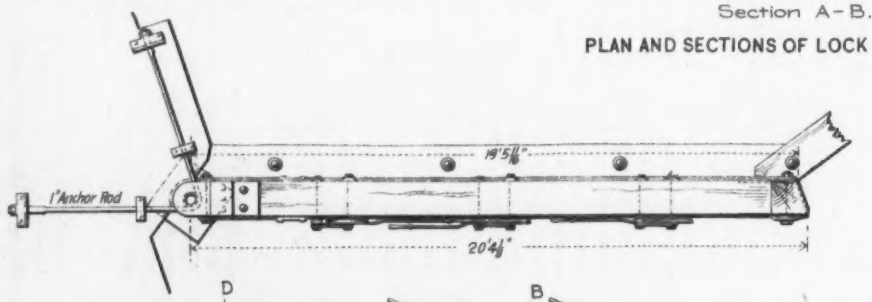
The safe arrival at New York of the French steamer "La Gascogne," seven days overdue from Havre, has been hailed with especial thankfulness, as the recent loss of the German steamer "Elbe" had increased the anxiety over the former steamer. The "La Gascogne" broke one of her piston rods, and after steam had been cut off from the cylinders affected (as repairs could not be made, the fracture occurring between the two pistons of tandem cylinders), the crankshaft bearings ran hot, owing, perhaps, to a slight bending of the shaft at the time of the accident, and the engine could, therefore, be run only at slow speed. Nevertheless, the steamer completed the voyage under her own steam, in spite of heavy storms, proving the stanchness of the vessel and the capability of the engineers. A large part of the credit and public laudation goes, of course, to the captain, who is more in evidence as the man in authority, but without detracting in any way from the credit due to him as the navigating and responsible head of the ship, it is only fair to refer to the important and successful work which the engineer staff accomplished. Such difficult and successful work in emergencies has again and again been done by the engineers of large steamers, often under conditions of great difficulty and danger, one of the most conspicuous cases having been the splicing of the broken shaft of the Cunard steamer "Umbria," as described in our issue of Jan. 5, 1893.

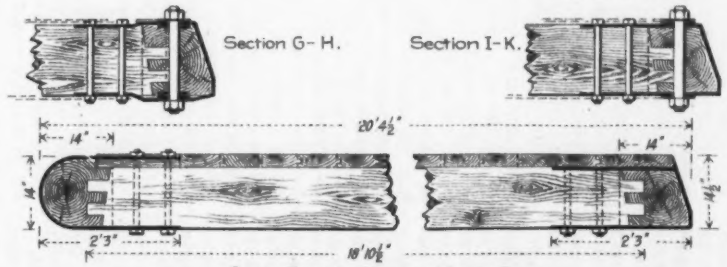
COMPENSATION BY FEES FOR ENGINEERS.

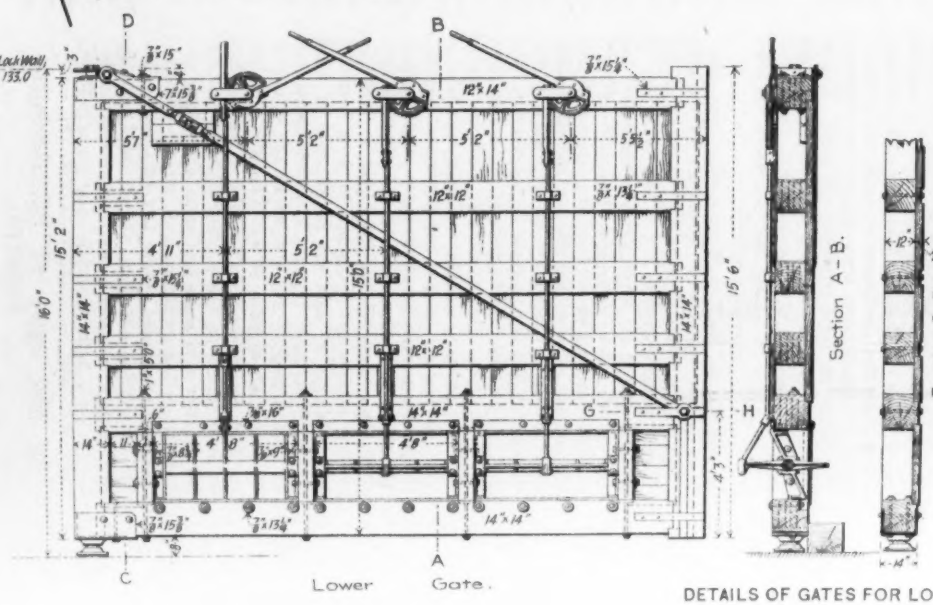
Some fault has been found by bridge engineers with the amount of money offered as prizes for the accepted plans of the proposed bridge over the St. Lawrence River, at Montreal, advertised in our issue of Jan. 24. The sums named are $1,000 and $500 for the first and second best plans. As this

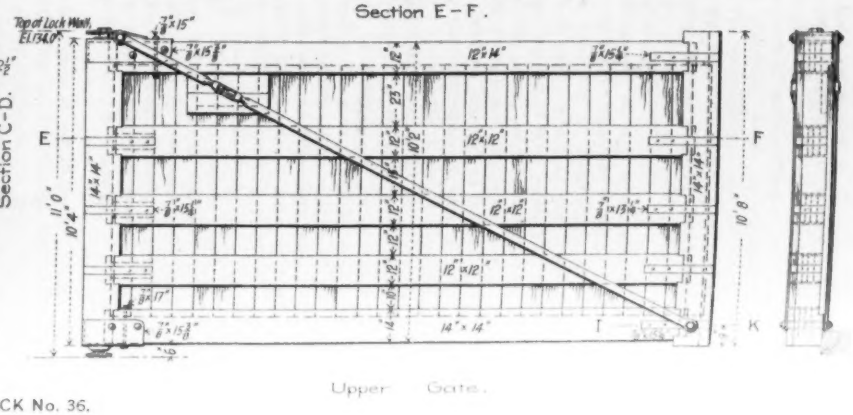


PLAN AND SECTIONS OF LOCK No. 36.



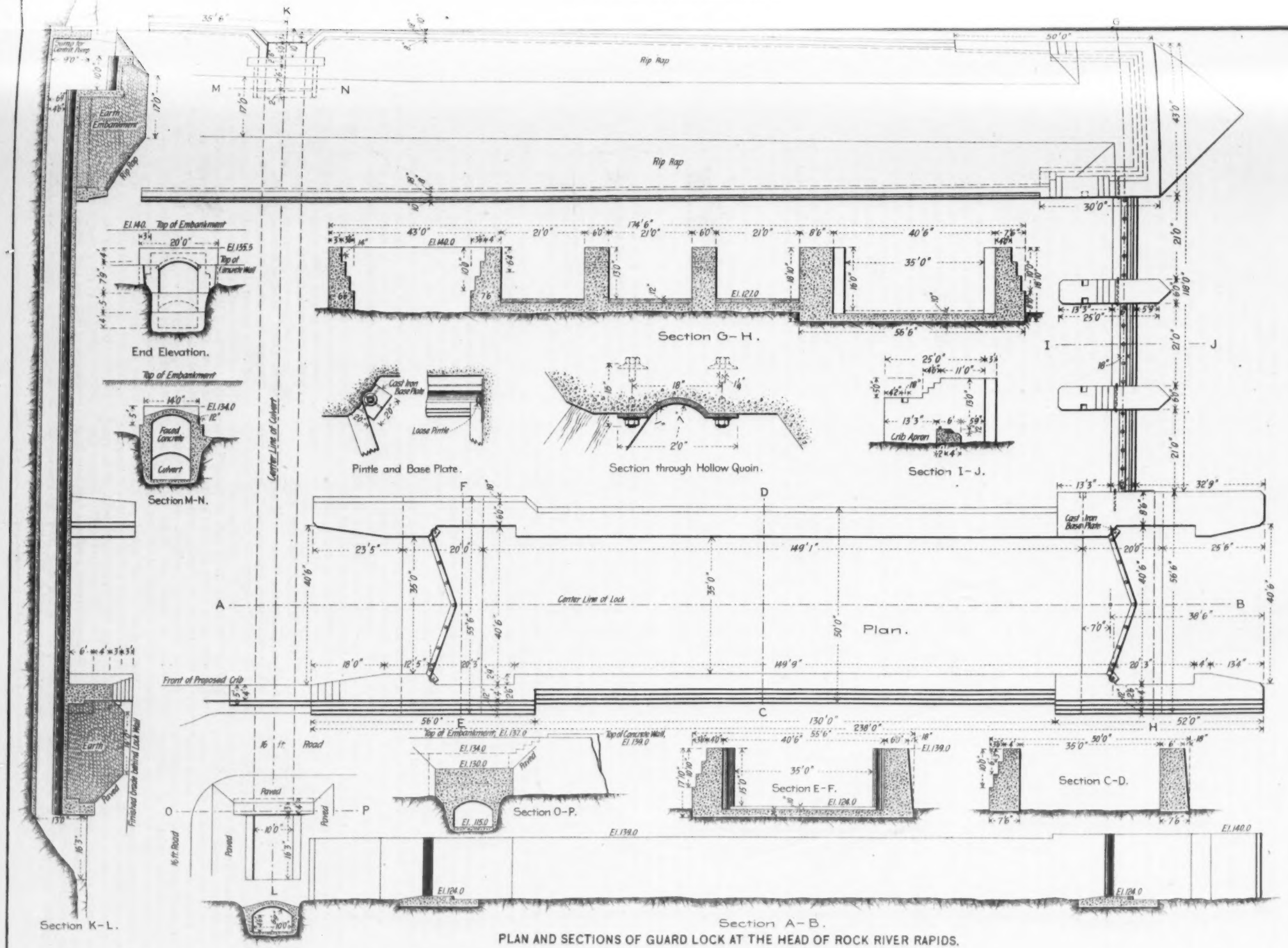






DETAILS OF GATES FOR LOCK No. 36.

DETAILS OF GATES FOR LOCK No. 36.


Rip Rap
Earth Embankment
Rip Rap
Rip Rap
Center Line of Culvert
Center Line of Lock
Front of Proposed Crib
16 ft. Road
Paved
Earth
Finished Grade behind Lock Wall
Top of Embankment
Found. Concrete
Culvert
Cast Iron Base Plate
Loose Pintle
Crib Apron
Top of Embankment
Top of Concrete Wall
Paved
Paved
Paved
Paved
Earth
Rip Rap
Rip Rap
Rip Rap

bridge is to be a very important structure, with a channel span of 1,250 ft., and an estimated cost of about $6,000,000, these amounts would seem very inadequate if they were all that the successful designers were to receive for the professional skill and experience necessary for the proper preparation of such plans. But the Montreal Bridge Company sends out its notice to engineers and to bridge builders, and it is most probably from the latter class that the company expects to receive its best plans and its most favorable propositions. There are a number of prominent bridge-building concerns in the United States fully equipped for designing such a bridge, and if the award falls to one of these corporations the amount of the prize is immaterial; the profits would be provided for in the construction and erection price. What the Montreal Bridge Company will not get, however, and what it does not seem to seek, are the valuable professional services of the older bridge engineers not connected with bridge-building firms. These men could not afford to sell their time and experience merely for the prospect of obtaining the sums named in competition with other engineers of like reputation, and the proffered employment on the bridge during construction would be no inducement at all.

The English fee system is often quoted as presenting advantages of which American engineers would gladly avail themselves. But there are several sides to this question, and if the welfare of the majority of engineers is to be considered, the American plan seems to be the best. The system of paying to the designing and superintending engineer a percentage upon the cost of the structure, in return for his services, undoubtedly greatly swells the professional incomes of a few very prominent English engineers. But this system also tends to keep the majority of the engineers of that country in very subordinate positions, with slow promotion and on salaries less, on the average, than prevail in this country. The English engineer, under this system, pays all his engineering assistants, inspectors, clerks of the works, etc., and is supposed to foot all incidentals usually coming under the head of engineering expenses, and, as a rule, estimated at about 10% of the total cost. Under such conditions the engineer is entitled to a liberal percentage, or fee; and even then he is not always satisfied, for we find Mr. J. Wolfe-Barry, the Engineer of the Tower Bridge over the Thames, laying claim to an extra allowance of $82,250, in addition to the stipulated sum based upon his original estimates, for money "actually expended" by him in connection with that work.

The tendency of American practice is now to pay to the engineer in responsible charge more liberal salaries than lately prevailed, and many consulting engineers in this country are paid special fees fixed upon beforehand for special work, and their professional income is only limited by the amount of work they can secure and the assistants they can employ. So far as we now recall, only one American engineer has attempted, on any important scale, to introduce the English system of payment by percentage of cost into this country, and the result will be awaited with considerable interest.

The fact that American architects are ruled in their professional charges by a regularly-established schedule of percentages upon cost of the work in hand does not seem to apply to American engineering practice. In any event, the system is not applied, for several practical reasons. Bridge design and erection would seem to be as well adapted to such a basis of engineering charges as is an important building for the charges of the architect. And under such conditions, say, at only 1 per cent., the design alone of the steel work of the Montreal bridge, estimated to cost $3,500,000, would amount to $35,000. This would be a very comfortable fee, and we would be the last to deny it to the engineer, had he any reasonable prospect of obtaining it. But, unfortunately for the engineer, the bridge company can get a first-class design in a cheaper manner, and will always do so under present conditions. There are now many large bridge-building concerns in this country that are able to and generally do retain in their service the best engineering talent available. Such companies will willingly go to all the necessary expense of preparing and presenting plans for a large bridge upon the mere prospect of securing the work, and its possible profits. Such corporations are also often able to assist the bridge company in carrying heavy financial loads during the progress of the work, and in other ways can usually make terms so advantageous to the party of the first part that an engineer presenting only plans, no matter how meritorious, stands small chance, in comparison.

In railway practice, it is not a question of preliminary design, but of preliminary work in the field; and until the engineer's work is practically concluded, there can be no estimate of ultimate cost upon which to base any percentage. The practice also varies so much in the character and cost of railway work that any such basis would lead to endless confusion and controversy between the engineer and his employer, and ultimately defeat its own purpose. In special engineering work an engineer of experience and reputation can usually now fix his own compensation, as before mentioned; but there seems to be no good reason for claiming that the rate charged by this engineer should also fix the compensation of all engineers for similar work, regardless of previous experience or hard-earned reputation. In any profession, the best man usually reaches the top of the ladder; and when he has once proved his capabilities, all other things being equal, his services will be sought and paid for in proportion.

This rule also practically applies to American architects, with all their oft-quoted schedule of fees. The large fees—or what amounts to the same thing, the important and costly buildings—fall to the share of those who have made themselves prominent in the architectural world by similar important work performed. The large majority of architects, and especially the younger men, must content themselves with cheaper structures and smaller fees until they can attract attention by some unusual display of professional skill. And, meanwhile, many of these younger architects, and some of the old ones, are paid less than the average engineer whose compensation is not controlled by a schedule.

Happily, the public employing engineers is gradually arriving at some better estimate of the money value of engineering service; and work requiring special training and experience is better paid for now than it was a few years ago. In this way the door is now open to all who possess ability to begin with and honestly and earnestly seek to excel in some special branch of their profession, and thus lift themselves up above the heads of mediocre brother engineers. This elevation means hard, persistent work, and it may take time; but there is no royal road for engineers, any more than for members of any other profession. Knowledge and experience must first be gained; reputation will follow, and the compensation will be measured greatly by the demand for expert services. Young engineers are apt to forget, in comparing engineering with other professions, that while nearly every one, at some time, requires the services of a doctor, a lawyer, or a minister, comparatively few absolutely need to call in the engineer. But when people really do want an engineer, they want him badly and want the best that can be had—and they should be willing to pay a fair return for his services.

CAN WE MAKE IT RAIN?

"Can we make it rain?" is certainly the modern counterpart of the question propounded to Job by the voice from the whirlwind: "Hath the rain a father?" The paternity of the rain has indeed been claimed by men in all ages, and the modern claimant differs from his predecessors only in having used "science" instead of superstition in the conception of his offspring. In another column we have outlined briefly the work of rainmaking, which the Chicago, Rock Island & Pacific Ry. has been conducting during the two seasons past, and proposes to continue during the coming summer on such of its lines as penetrate the arid and semi-arid regions. The evidence for and against the claim that rain has been actually produced through the efforts of these rainmakers we lay before our readers for what it is worth. In sifting this evidence, it is well to consider for a moment how rain is produced in nature. The aqueous vapor of the atmosphere which condenses into cloud, and falls as rain, is derived from the evaporation of water, partly from the earth, but mostly from the ocean. A warm air holds more moisture than a cold air; and consequently if a saturated air is cooled, it precipitates part of its moisture, or, in other words, it rains. It is now generally held that dynamic cooling is, if not the sole cause, at least the principal cause of rain. By dynamic cooling is meant the cooling of air due to expansion when raised in altitude and brought under less pressure. There are several different ways in which the air at the surface of the earth may be raised in altitude; but whatever the manner and whatever the altitude, the air must reach the point of saturation before the resulting expansion and cooling can produce rain. The reason why the arid regions of the earth are arid is simply and solely because geographical and meterological conditions are habitually such that moisture-laden winds are deprived of their moisture before reaching them, or, on the other hand, because there is nothing to cause the cooling of these moisture-laden winds and the consequent precipitation.

But, supposing the aqueous vapor exists in the air somewhat below the point of saturation, is it not reasonable to suppose that there may be some way of hastening or forcing condensation, so that rain will fall? If we trace the history of scientific rainmaking, we find that it is upon this hypothesis that most of the various theories are based. The best known and probably the oldest of these theories is that the agitation of the atmosphere produced by violent explosions acts to concentrate the particles of moisture, until it falls as rain. The popular belief that great battles have always been followed by rain has been much used as an argument in favor of this theory. Aside from the fact that this belief was prevalent long before the days of explosives, a careful summary of the great battles of the world and the character of the weather following them has shown conclusively that days of battle were no more likely to be followed by rain than days when it was quiet all along the line. As our readers will recall, the United States Government made some investigations of this "concussion" theory of rainmaking in the fall of 1891, and through the courtesy of the Department of Agriculture we have been furnished the barograph diagrams taken to show the amount of agitation of the air produced by the explosions. These show that, at a distance of half a mile from the point of explosion, the movement of the air was not sufficient to rustle the leaves of a tree, let alone the condensation of the moisture necessary for the slight rainfalls which followed one or two of the dozen experiments. In the same way the old belief that large fires, like our great forest fires, or the Chicago conflagration, brought rain by the raising of large masses of heated air, which in cooling formed clouds that expanded into the proportions of local storms, has been exploded by a similar compilation of facts.

Concerning the latest system of rainmaking, referred to above as having been taken up by the Chicago, Rock Island & Pacific Ry. Co., we present such information as we have been able to collect in another column. A word of explanation may be needful, however, to prevent misunderstanding and to answer in advance the criticisms of those who may object that "Engineering News ought not to give space to such 'fakes.'" We conceive it to be the office of a technical journal to publish information on all subjects of technical interest, together with such comment as may aid its readers to most clearly understand their significance. This alleged system of rainmaking has become more or less widely known through various newspaper articles, it has been taken up experimentally by a great railway corporation, and a large number of witnesses aver that remarkable results have actually been produced by it. These facts are sufficient to justify the presentation of information in these columns, even granting it to be absolutely certain that the scheme were a pure delusion; for it is as much a part of our work to expose the false and fraudulent as to present accounts of excellent work and improvements on former practice.

As for comments upon the system itself, criticism is largely precluded by the fact that it is entirely secret; and it is, of course, well understood that secrecy concerning such a thing is in itself very strong evidence that it is fraudulent. We are, therefore, obliged to fall back on general principles and to say that, so far as can be seen, any effective method of causing the precipitation of rain must operate through some cause proportionate to the effect produced. The chances are many to one that such materials and machinery as could be carried in one end of a box car could not cause the condensation and precipitation of some 60,000,000 tons of water over an area of several hundred square miles.

Reference to the article in another column will show that it is actually such an effect as this which is claimed for Mr. Jewell's rainmaking process. It is alleged by one witness that a rainfall of 0.78 in., extending over a radius of some 30 miles, occurred within seven hours of the time the "rainmaker" began operations. Reducing this radius by one-third, to allow for smaller precipitation in the outlying territory, we have still an area of over 1,200 sq. miles, and a precipitation of 0.78 in. means the fall of some 50,000 tons of water on a square mile. Other arguments of equal strength might be presented to show the improbability that the discharge into the air of any gas known to chemistry could cause condensation and precipitation over a wide area. As for the alleged successes, it must be remembered that because a rainfall occurs at a certain time and place is no proof that rainmaking operations carried on at that time and place had anything to do with it.

On the other hand, our knowledge of meteorology is not on the same basis of mathematical certainty as our knowledge of thermo-dynamics, for example. We cannot say positively that by no possible methods can a man cause the rain to fall, much as we may feel the exceeding improbability that rain can ever be produced by artificial means. The proper attitude of the engineer or scientist on this question, therefore, is to hear and weigh evidence without prejudice. If Mr. Jewell can water the great American desert with such simple and inexpensive machinery, as he claims, we shall be glad to see him prove it, even though we realize that the chances are many thousand to one that his shrewdness as a weather prophet lies at the bottom of any success he may have achieved, and that the juice which he distils with his secret apparatus is merely concentrated essence of humbug.

LETTERS TO THE EDITOR.

THESIS PRIZES FOR 1895.

Sir: Will a thesis on which three men work be eligible in the competition for the Engineering News thesis prizes? Are instructors allowed to make suggestions to students regarding methods and apparatus in experimental work? Yours truly, W. H. S.

(The prizes are given for quality of work, not quantity, and we see no more reason for debarring a thesis by three students from the competition than one by two students. No restrictions are made on the aid which students may receive, save the requirement that for any part of the thesis not original or for work recorded therein not performed under the author's direction due credit must be given.)

THE TOWER SYSTEM OF ELECTRIC LIGHTING.

Sir: It gave me pleasure to read the editorial note in your journal for Jan. 31 on "The Tower System of Electric Lighting." But I beg leave to add another reason (an all-powerful one) against its adoption. When put up so high the efficiency of the lights is greatly decreased, the erectors evidently forgetting that the intensity of illumination on a given surface is inversely as the square of its distance from the source of light. It seems strange that this fundamental law of physics is either forgotten or unknown by those in charge of the work. The city of Allegheny is lighted from towers, and is another non-shining example of this system. It simply lights up the sky for the benefit, probably, of the night-birds.

Yours very truly, A. E. Duckham, C. E.

Pittsburg, Pa., Feb. 4, 1895.

THE FLOW OF WATER OVER WEIRS.

Sir: Mr. Werenskiold's mathematical treatment of the flow of water over a weir, in your issue for Jan. 31, appears to be practically the same as that to be found in Flamant's "Hydraulique," p. 98 (Paris, 1891). By a different management of details in applying the calculus, however, Flamant's solution is somewhat more satisfactory, it seems to me. This author mentions the experimental fact that (using notation in Fig. 2 of Mr. Werenskiold's diagrams) the distance $H_1 - H = 0.13\,H_1$; and using this relation in his equations, deduces a fair correspondence between the discharge as given by his formula and the actual discharge for a sharp-edged weir. Flamant also gives substantially the same treatment for a wide-crested weir as that in the Encyclopaedia Britannica (quoted by Mr. Frizell on p. 74 of your issue for the above-named date), adding thereto the claim that the discharge must be a maximum.

Mons. A. Flamant is a French engineer and professor of some note.

Sincerely yours, I. P. Church.

Ithaca, N. Y., Feb. 2, 1895.

MOVEMENT OF WATER OVER A DAM WITH WIDE HORIZONTAL TOP.

Sir: I do not know that it makes any difference as to who may be the author of the formula for movement of water over a dam with wide horizontal top (see your issue of Jan. 31), but I think it is pretty well authenticated.

If you will turn to the article "Barrage" in Spon's Dictionary of Engineering (1871), you will find on p. 252:

$$Q = \frac{2}{3\sqrt{3}} L\,h\sqrt{2\,g\,h},$$

which looks to me very much like

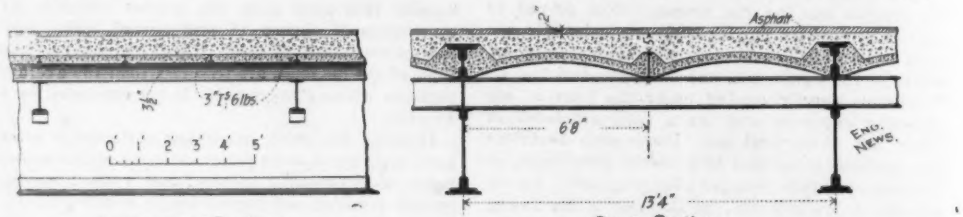
$$Q = \frac{2}{3}\,L\,h\sqrt{2\,g\,\frac{h}{3}}.$$

Yours truly, C. H. Fulton.

Buffalo, N. Y., Feb. 11, 1895.

PUBLICATIONS OF THE UNIVERSITY OF WISCONSIN.—CORRECTION.

Sir: In your issue of Jan. 24, you gave a pleasant notice of Mr. Purdy's lecture on "Steel Construction of Buildings" and made the announcement that copies could be obtained by sending a 2-ct. stamp to me.



Longitudinal Section. Cross Section.

BRIDGE FLOOR OF CONCRETE AND IRON ON THE MELAN SYSTEM.

Up to date from this announcement we have received nearly a hundred applications for this number of our University Bulletin, and the "returns are not all in" yet, I suppose. The copy sent you did not state the price, nor show how persons outside the state could obtain the Bulletin, but you will see by this copy of a later issue that the price is 25 cts., copies being free only to residents of the state. This somewhat curious "local" provision is due to the fact that the Bulletin is in a certain sense a public document, being printed by the State Printer.

May I ask you to make a brief statement correcting the free distribution announcement. It is flattering both to your paper and to our Bulletin that a brief announcement brings so many requests, but if the requests keep coming, we shall have to print a new edition—a procedure not provided for.

Very respectfully yours,

Walter M. Smith, Librarian,

University of Wisconsin, Wis., Feb. 1, 1895.

PRACTICE AND THEORY OF THE INJECTOR.

Sir: I acknowledge with thanks the receipt of your issue containing the notice of my book on the "Practice and Theory of the Injector." Unbiased editorial opinions cannot but be of use to those who place before the public their ideas upon scientific subjects, for the very familiarity of authors with their subjects is apt to lead to omissions of explanations which might be advantageous to the reader.

It may be interesting to your reviewer to know that the statement on p. 90, which he criticised, is correct. The capacity of a non-lifting injector is not increased by the addition of pressure upon suction above that head and at that steam pressure for which the combining tube is proportioned. A locomotive non-lifter is usually designed to give the maximum capacity under a suction pressure of about 6 ft. when the steam pressure is 120 lbs.. At this steam pressure any increase in the suction pressure above 6 ft. will cause an overflow at the waste-pipe and no more water will be forced into the boiler than before; if the overflow be closed, the jet will break. If, however, the steam pressure be raised, a higher feed head can be used, but if the steam falls below 120 lbs., the suction pressure must be reduced. If the distance between the steam nozzle and the combining tube can be varied, then the head can be changed and the capacity slightly increased with higher heads, but there are no modern locomotive injectors of this type in use. I had thought that this point was sufficiently explained in the chapter upon the combining tube, but a few additional lines at the place criticised might not be out of place.

Further, the subject of the exhaust injector was treated in the chapter on the theory, p. 74, and an example worked out; it was therefore not thought advisable to repeat in the pages following, although the fact that an apparent omission has been noted, leads me to doubt the accuracy of my previous opinion, and that it might be better to treat this pattern, as well as ejectors, a little more fully in a future edition, in case the long-suffering public demand it.

Thanking you for the courteous treatment which both the book and its author have received, I remain,

Yours very truly, Strickland L. Kneass.

418 So. 15th St., Philadelphia, Jan. 23, 1895.

CONCRETE AND IRON BRIDGE FLOORS.

Sir: In your issue of Sept. 6 you published drawings of a solid bridge floor which is a combination of concrete and iron, and I submit to the attention of your readers a design by Professor Melan of the same combination, which was designed for a plate girder bridge at Budapest, Hungary, which has to carry a wheel load of 6 tons. The advantages of this over the corrugated plate design are as follows:

1. In the latter floor the whole lower surface is of iron and has to be painted and repainted, while the Melan floor shows a damp-proof surface and there is but little expense for maintenance.

2. The arrangement of arches between the beams makes the floor both stiffer and stronger, as proved by a test in which a floor similar to that shown, of the same span, with 3½-in. I-beams 40 ins. apart, was loaded with 2,400 lbs. per sq. ft. without injury.

3. The corrugated plate floor referred to has 14 lbs. of steel per sq. ft., = 21 cts. The Melan floor has 3-in. bent I-beams, 6 lbs. per ft., 3 ft. apart, which gives 2 lbs. of steel per sq. ft., = 4 cts. This difference is reduced by the addition of the concrete arch, which is 3½ ins. thick, and, including spandrels, worth 11 cts. per sq. ft., making a total cost of 15 cts. The cost of filling with concrete and covering with asphalt is the same in both cases, and there remains a saving of 6 cts. per sq. ft., or 30% of the cost.

4. The Melan floor requires no riveting.

Metallic floors have also been referred to in your issues of Oct. 11 and Nov. 15, and reference has been made to the corrosion of such work. The best remedy for corrosion is to have the iron completely covered by concrete, especially in those parts near the floor which it is practically impossible to examine and repair. This is effected in the bridge floor shown in the accompanying design.

I may mention that at Cincinnati, O., I have erected a 70-ft. arch of the Melan construction.

Yours truly, Fr. von Emperger.

New York, Dec. 10, 1894.

CONCERNING VOTES ON REJECTED APPLICATIONS FOR MEMBERSHIP IN THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

Sir: I have just read the editorial comments in Engineering News of Feb. 7 regarding the proposed amendment of Art. 3, Sec. 5, of the constitution of the American Society of Civil Engineers, and beg to call your attention to an evident misunderstanding of the extent of the proposed amendment.

1. Under the present rule it require 10% of all the votes cast to exclude; hence there is no change proposed in this particular.

2. The one modification proposed is that these special ballots shall be signed; that the vote shall not be secret. The only effect hoped for is that members will not thoughtlessly, inconsiderately, or at simple request black-ball a reconsidered candidate who goes out before the membership a second time, if he goes

at all, with the indorsement of eight or more members of the Society, not members of the Board, together with the recommendation of the Board itself.

The average number of votes for membership elections seldom exceed 300 to 350; consequently, it is not so difficult a matter for a vindictive person to obtain the required number of adverse votes, on purely personal reasons, when the ballot is secret.

There seems to be no manly argument against this proposed amendment; for if a member has a valid reason, good enough to cause him to desire the exclusion of a candidate, then it would seem to be his duty to put the members, who have been elected to the Board for the purpose of conducting the Society's business, in possession of such knowledge; else, how can it properly act? To withhold such damaging evidence, if it exists, and thus permit the special recommendation of a candidate, and to again use the sand-club of darkness, is, in my opinion, cowardly and contemptible. There has been for such action but one fairly good excuse heretofore offered, namely that too many members regard election to the Society as if it were a social club. Obviously, a mere matter of personal dislike may be ample reason for rejection in a social club, but it is equally clear that such a reason should not cause rejection, if other things are satisfactory, in the American Society of Civil Engineers.

If you will refer to the enclosed blank you will see that the Board, in fact, does hold to "strict accountability" the members who finally become the indorsers of a candidate. Furthermore, you are in error regarding a candidate being required to "obtain the signatures of five good-natured members" as the applicant is himself required to fill in the names of his references; and you will find on the blue lists the statement, prominently displayed thereon, that a reference is not necessarily to be considered as an indorser. This system leaves the most perfect freedom upon the part of the referee, and as you will see by the enclosed blank, the member who becomes sponsor for a candidate is not only forced to be "extremely careful," but, being under no restraint, and not being brought in conference with the applicant, his report may be entirely free and open.

I believe our system is about right in principle, and that the practical results will compare advantageously with those of the Institution to which you refer. And in this connection, it might be worth your while to read the correspondence by a member, or members, of the Institution in "Engineering," which I noticed some months past, and in which the monarchical system of the Institution is quite strongly criticised, and the Democratic method of the Am. Soc. C. E. is held up as a pattern for adoption.

I may furthermore call your attention to the fact that the enclosed blank to be filled by indorsers, though brief, requires personal acquaintance and the length of time such acquaintance has continued; an expression as to personal character and as to personal reputation; an opinion as to professional reputation; a definite knowledge as to time engaged in professional work, and as to responsible charge; an opinion as to ability to design and to direct, and a final definite indorsement "I do" or "I do not believe the applicant to be a proper person to be admitted into the Society."

In closing I beg to say that I believe you are to be commended for taking this matter up and giving it publicity, for the subject is worthy, and the general result ought to be beneficial. But I trust the immediate result of your observations may not be to defeat the proposed amendment, which is believed to be in the line of progress. The American Society of Mechanical Engineers has also but recently made important changes in this regard, modeled somewhat on the lines here outlined. Consequently, the evident trend and effort of these two leading technical societies are to advance the standard, professionally and socially, thus aiming to make more valuable the standing and the recognition of the real "lever" which, in the past as in the present, "moves the world"—the engineer. I beg to remain, very truly yours,

John Thomson.

253 Broadway, New York, Feb. 9, 1895.

(We comment upon this letter in the editorial columns.—Ed.)

WHERE THE PENNSYLVANIA R. R. IS NOT IN A CONDITION FOR TRAINS.

Sir: When a railway officer responsible for the movement of trains is up to his eyes in work, breaking a snow blockade and getting traffic moving in regular order again, it is not with unalloyed pleasure that the interruptions of inquisitive reporters are endured. After the heavy storm of last week, an "Evening Post" reporter went to the Pennsylvania offices in Jersey City in search of information concerning the condition of traffic on that road. Like most reporters he was in search of news, and the information that trains were moving regularly was too commonplace a story; he proceeded to cross-question his informant, and to try to extract from him admissions concerning the interruptions, delays and blockades on various parts of the line. The official at first took refuge in general denials; but at length he thought it a pity that so astute and well-informed a young man should have his search for interesting news unrewarded and gave an apparently reluctant admission that sent the reporter away happy. That day's "Evening Post" wound up an article on the railway blockade as follows:

Assistant Trainmaster Black, of the Pennsylvania R. R., said this morning, that probably no effort would be made to send out any trains west of Chicago or south of Washington, the condition of the road not warranting it.

Yours truly, Q. J. K.

RULES FOR SHOP DRAWINGS.—CORRECTION.

Sir: I notice that a line has apparently been omitted in the article on "Shop Drawings" in your last issue. The paragraph where the omission occurs should read as follows:

Size of Sheets.—Drawings will generally be made on sheets 26½ × 35½ ins. inside border line. Small drawings, such as details of castings, etc., may be made on sheets 8½ × 14 ins. One of these two sizes is to be used in all cases.

Respectfully, Chas. H. Wright.

Wilmington, Del., Feb. 11, 1895.

EXTREME CASES OF SETTLEMENT OF BUILDINGS.

Sir: We have from time to time read your paper with great interest, and would be obliged to you if you would let us know in your next issue of cases of heavy buildings having settled a foot or more without receiving substantial damage. Thanking you in advance for your trouble, I remain,

Yours truly, T. J. Preston, Jr.

Newark, N. J., Feb. 12, 1895.

(There are few records available for the extreme cases referred to by our correspondent; and the expression "substantial damage" may be variously interpreted. Structures of any considerable weight erected upon the alluvial soil of New Orleans, for example, nearly all settle to a considerable extent, and this settlement is generally expected. The U. S. Custom House in that city, a heavy granite building, was founded upon a thick bed of concrete and the weight was purposely so distributed by arches that it was expected that the settlement would be practically uniform. We believe the building did sink a foot or more; but the cornice shows a waving line, indicating unequal settlement. The building, however, was not substantially damaged. The old New Orleans Public Library, founded upon a timber grillage, settled, it is said, about 15 ins. without material harm to the structure. The Calcutta High Court Building, built in 1870, has settled 9½ ins. in a soil somewhat similar to that of New Orleans; but the towers leaned out 11⅔ ins. in a height of 87 ft. and the foundation has been lately underpinned to prevent further settlement and leaning. We would be obliged to any reader furnishing further extreme cases of this character, which, doubtless, exist in abundance.—Ed.)

TESTS AND SPECIFICATIONS FOR ASPHALT PAVING.

Sir: Mr. Arthur C. Harris, President of the Board of Public Works, Denver, Colo., in a circular letter printed in your issue of Jan. 17, makes a curious request and inquiry. He desires "to find a simple and correct method whereby a man not a chemist"—and presumably not experienced or competent—"can test asphalts, and be able to determine whether they are or are not suited for paving purposes, and whether one asphalt will make a better paving surface than another." And he inquires: "Is it a fact that skill in manipulation is as important a factor in producing good results in asphalt paving as the quality of the asphalt itself? In other words, is not one workman uniformly as good as any other?"

Recognizing in this communication, however, an honest and earnest desire for information, the following, based on 25 years' experience and observation relating to this specialty, is submitted: All bituminous pavements are made up of two essential parts; the cementing material, either in a natural state, as asphalt, or in a produced state, as pitch or tar, either mineral or vegetable; and the resisting material, as stone, gravel and sand, compacted in place and bound together by the cement. The function of each is quite dissimilar—the one preserves the coherency of the resulting mass, the other resists the wear in service.

For cementing material, most of the bitumens are equally fit, if they by special treatment have been entirely freed from extraneous matter, as the fluids, which in the natural or commercial substance are entrapped therein and vaporize at a comparatively low temperature; the resulting compound being of the proper consistency, adhesive, stable, and slowly affected by exposure. Heat is a necessary agent in the preparation of the cement. It should be so applied as to expel all of those vaporizable fluids, and yet not, by destructive distillation, generate others. The best asphalt may be injured by unskillful treatment, as the poorest may be made more suitable by skillful manipulation. For resisting material, tough, hard stone, broken angularly in different sizes, is best, although sharp gravel and sand may be used in whole or part. Each should be made clean and quite free from dust. These two elements having been carefully selected and skillfully prepared, a good pavement is not assured unless these be carefully intermixed and in the correct proportions. Again, for an enduring pavement, a firm, unyielding foundation must be provided. Otherwise, no matter how good the surfacing matter may be, or how carefully it is compounded and placed, the pavement will fail.

By means of a comparatively simple apparatus, and in a brief time, the cementing material proposed to be used may be tried, and whether it comes up to the required standard may be determined. If, however, it does satisfy these tests, it may be much changed and deteriorated in the process of laying the pavement, since this must also be done with heat.

The whole matter, therefore, is subject to the old rule, "Know how and do well." In this, as in other engineering specialties, of those who desire to do good work, those who have the most experience and use the best materials will lay the most satisfactory pavement, and an uninformed layman can only judge of the comparative quality of pavements after a period of use has determined their relative merit. He who is about to order new work, however, may safely accept the propositions of those whose record for excellent construction is established, and as safely reject all offers from others who may solicit him to try experimentally what, per force, from a lack of practical and enduring service, he can know nothing about. And finally, he will be wise to have all paving done under the supervision of a competent inspector, fully vested with the requisite authority to reject faulty material and workmanship, and to direct independently the methods and operations to be pursued.

Yours truly, G. Leverich.

179 Washington St., Brooklyn, N. Y., Feb. 1, 1895.

Sir: The communication of Mr. Harris in the issue of Engineering News of Jan. 17 voices the troubles of many engineers and city officials throughout the country. Engineers have been using asphalt for street paving in the United States for the past 20 years and are still ignorant of the qualities the materials should possess. The majority of the specifications for asphalt paving require the asphaltum to be "obtained from the pitch lake on the Island of Trinidad," while the name of the company furnishing the material is taken as positive proof of its origin. This requirement and the stipulations regarding the ingredients and the manner of mixing have usually been borrowed from specifications compiled and circulated by asphalt companies. The fact that engineers have passively allowed such a state of affairs to exist for 20 years is a discredit to the profession. An engineer in charge of construction should never use a material whose qualities are assured only by the bond of the furnishing company.

The one fair and professional basis for the construction of an asphalt pavement is to judge the ingredients and resulting mixture by certain test requirements, thus leaving the field open to all materials, regardless of source of supply, that meet these requirements. This method is pursued in other lines of engineering construction, but the entire asphalt question has been so successfully covered with the cloak of secrecy that engineers are ignorant of the qualities, the ingredients or the resulting mixture should possess to secure a good pavement. The so-called asphalt experts make minute chemical analyses of the asphaltum giving the per cent. of bitumen soluble in ether, alcohol and turpentine, the per cent. of ash, organic matter and a dozen more "per cents.," and conclude by saying that the value of the asphaltum as a paving material cannot be judged by such analyses. If such be the case, what is the necessity for chemical analyses in determining the quality of a given kind of asphaltum?

Structural iron or steel must possess certain chemical characteristics, but the presence of these chemical constituents is determined by results of physical tests. Mr. J. W. Howard says: "The commercial value of an asphalt depends principally upon its physical characteristics." Again, it is claimed by some asphalt men that the excellence of the wearing surface is not dependent upon the quality of the ingredients, but is secured entirely by proper mixing. There is apparently no more reason for such an assumption than there would be for a statement that the quality of concrete is dependent entirely upon the manner of mixing, regardless of the quality of materials used.

If an asphalt pavement conforms to the same laws as all other engineering structures, the following are true conclusions: (1) The best quality of the several ingredients are necessary to secure the best wearing surface; (2) The strength of the pavement depends, in a large measure, upon the proper mixing of the ingredients and method of laying; and (3) Standard physical tests alone are necessary to determine the quality of the ingredients and resulting mixture. In order to place this matter on a firm foundation, is it not feasible for the American Society of Civil Engineers to investigate the subject, determine the requirements for each ingredient and the mixture to procure the best asphalt pavements and recommend standard physical tests, or chemical tests if necessary, to determine these qualities? This society recommended standard methods for cement tests, and it can do no greater benefit to the profession than to settle this vexatious asphalt question.

Yours very truly, A. D. Thompson,
Assistant City Engineer.

Peoria, Ill., Jan. 26, 1895.

(In this connection we may quote also from a statement recently made by Mr. Chas. C. Brown, City Engineer of Indianapolis, as follows.—Ed.)

Our judgment regarding a paving material is derived from a study of its action in use, believing that actual use is the only complete test of paving materials. No laboratory tests have yet proved satisfactory as indications of the value of a paving material. When an asphalt has been shown to be good material for paving, tests are prepared and it is easy thereafter to determine whether the asphalt bid upon is furnished.

Skill in manipulation is equally as important as quality of material. Good material can be entirely spoiled by poor workmen. Our specifications demand evidence of ability to lay good pavement as well as evidence as to value of material.

Our policy thus far has been to try no experiments but to let contracts only for materials which have been tested in actual use and to contractors who show evidence of ability to lay good pavements. We have received bids during the past year from the Warren-Scharf Asphalt Paving Co., the Western Paving & Supply Co. and the Trinidad Asphalt Refining Co., all using Trinidad pitch asphalt, and from the Indiana Bermudez Asphalt Paving Co., using Bermudez asphalt, and have let contracts to all of them. Bids have been received from the Alcatraz Asphalt Co., using California asphalt, but the question of the acceptance of their product did not arise as their bid was not the lowest. Samples have been filed by Wilding, Derheimer & Co., using Kentucky rock asphalt and an asphaltic flux, and by the Fruin-Bambrick Co., of St. Louis, using Trinidad land asphalt, but bids have not yet been presented by them.

Our specifications call for Trinidad Pitch Lake asphalt, or an asphalt equal in all respects or superior thereto. The specification was changed in April, and our bids during the year, according to my estimates, have ranged as follows, per sq. yd.:

March 5, $2.85; April 18, $2.77; April 30, $2.51; May 23, $2.44; July 25, $1.97; Aug. 29, $1.80; Sept. 19, $1.70; Dec. 26, $1.94. Previous to the change we had bids from but two companies, both using Trinidad Pitch Lake asphalt under the specifications. The above shows the effect of competition. All the above streets were laid with Trinidad Pitch Lake asphalt, except those dated May 23 and Aug. 29, which were laid with Bermudez asphalt. The above are one-third of the asphalt contracts let during the year. Very recently bids have been received for land asphalt, but they were rejected, although the lowest, in favor of Bermudez asphalt, on the ground that land asphalt did not comply with the specification.

NOTES AND QUERIES.

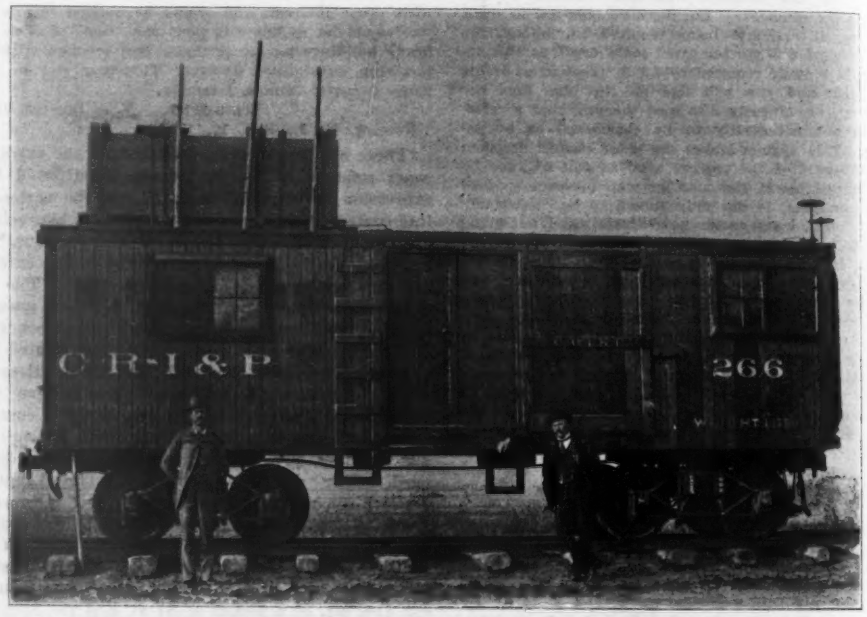
M. E. R. wishes to know what methods have been employed to lay telephone wires in water-works tunnels or other intakes extending from shore to lake cribs while the tunnels or intakes remained in active operation.

"RAINMAKING" ON THE CHICAGO, ROCK ISLAND & PACIFIC RY.

Ever since the famous expedition, in the fall of 1891, of Gen. "Cloud-Compelling" Dyrenforth and his party of assistants to bombard the skies which overhang the arid plains of Texas, there has been a good deal of popular interest in the subject of rainmaking. The "bomb" method, by which the atmosphere is "whacked" with explosions until it sheds drops of moisture like an erring school boy, has yielded its place in popular favor to a more mysterious process, by which certain unknown gases are poured forth from a secret apparatus. If the claims of the originators of this process are to be believed, these gases possess a potency only to be compared with that of the mysterious "vapors" in the "Arabian Nights," which, issuing from a tiny casket or a nut were transformed into a palace, a fortress, an evil genie, or other object whose volume bore no relation to the size of the original containing vessel.

During the past two or three years various scattered newspaper articles have given information concerning the working of this process at various points; and while we are accustomed to place small reliance on newspaper reports concerning any technical matter, our curiosity was aroused by the statement that the Chicago, Rock Island & Pacific Ry. Co. had interested itself in the matter, and we, therefore, applied to officials of that company for a verification or contradiction of the reports. We are indebted to their courtesy for the following information, which we present substantially as received, commenting upon it in our editorial columns.

The system of "rainmaking" used by the Chicago, Rock Island & Pacific Ry. Co. consists in injecting a gas, or mixture of gases, into the air which "supply the element lacking in the atmosphere, in order that rain may fall." The composition of this gas or mixture of gases is a secret with the inventor, Mr. C. B. Jewell, of Goodland, Kan., a train despatcher in the offices of the above railway. In a letter to us Mr. Jewell describes his apparatus and mode of operation in a general way. The laboratory used in the field is a freight car, at one end of which three pipes project up through the roof. Each of these pipes divides into two pipes just inside the car and the six pipes connect with six jars in which the gases are made. The letter continues:



LABORATORY CAR USED BY THE CHICAGO, ROCK ISLAND & PACIFIC RY. CO. IN ITS RAINMAKING EXPERIMENTS.

On the opposite side of the car is a long shelf on and under which we keep our materials. Directly over this shelf is a second shelf divided into 13 compartments, in which rests our battery. At the end of the battery there is a large jug which is filled with a solution and is connected with the battery, which is also connected with the six large jars in which we make the gases. The tank shown on the top of the car is filled with water. This water we prepare before using, making it as soft as possible. The pipe near the left end of the car runs from the sink inside to a large hole dug in the ground to hold the waste. Sometimes this pipe is used as a ground connection from the battery. The other end of the car is partitioned off and is used for a sleeping apartment and office. My entire time is taken up while on the road answering correspondence, which comes from all parts of the world, and attending to the machine, which is operated night and day. I have used this process on the line of this road for two seasons. Last year I had three cars just like the one I send you photograph of, and expect to have several more this year. Had there not been such hard times, several of the railroads in the arid regions would have used my process in 1894. My materials are furnished in Chicago by several different houses, and neither house knows what the other house furnishes, or which the other houses are. The men who operate the cars for me do not know what they are using, but simply follow my instructions.

My process has been used 68 times and at no time have I failed to produce rain, but at four places the rains were mere sprinkles, and were termed failures, and to save argument were so admitted by me. These failures were due to very high and changeable winds. There are no phenomena connected with these artificial rains any more than with a natural rain. Mind you, we do not make rain. All we do is to bring about the same conditions which nature does when rain is produced, and when we do this a natural rain will fall. Nature and her laws are never wrong, and all efforts in this line must be made in accordance with the laws of nature, or failure must follow.

Briefly described, therefore, the rainmaking system of the Rock Island road is to run one or more cars into the territory which needs rain and start the manufacture of the mysterious gases which escape through the pipes in the car roof. An effort has been made to get a description of some of the phenomena attending one or two of these rains, but nothing of much value has been secured. The following letters give the most definite information:

Sir: In answer to your favor permit me to relate the actual experiments which were made here about two years ago. We were suffering for want of moisture, and I made application to our official department to have Rainmaker Jewell come here and make a test. At about 2 p. m. he commenced operation, the skies were cloudless, and at about 5 p. m. the clouds began to appear, and at 9 p. m. we had a rainfall of 0.78 in., as shown by the government gage. This included his first test at this point. The second test was followed by better results, there being a precipitation of 1 in. of rain. In the spring of 1894 we had him here again, the weather was cool and the experiment was not a success, which I firmly believe was due to the unfavorable weather. The last experiment was conducted by H. Hutchinson, one of Mr. Jewell's substitutes, and who is not well versed in the science of electricity, which is an essential factor in tests of this nature. There is one point in your letter which I failed to answer, and that was the territory over which the rainfall extended. I would call it a local rain, as it did not extend over a radius exceeding 30 miles. I have no interest in Mr. Jewell's rainmaking scheme, and have given you the plain facts, as I was very much interested in the matter and gave it close attention. Yours truly, J. B. Bailey.

Phillipsburg, Kan., Jan. 29, 1895.

Sir: Mr. Jewell gave us a fine shower in, I think, three days. He stationed one car at Mankato, one here and one at Beatrice, Neb. We had a heavy rain from east of Beatrice to west of Mankato, about 60 miles. I do not remember what the fall of water was, but think it was 3½ ins. I have all confidence in Mr. Jewell's power to produce rain.

Yours truly, J. A. Whittemore

Belleville, Kan., Jan. 26, 1895.

Both of the above writers are connected with the Chicago, Rock Island & Pacific Ry. In a personal interview Mr. W. I. Allen, Assistant General Manager of this railway, stated to one of the editors of this journal that he had great faith in the ability of Mr. Jewell to produce rain. So firm was his faith that the company had experimented with the system during the two seasons past and should continue the experiments the coming season.

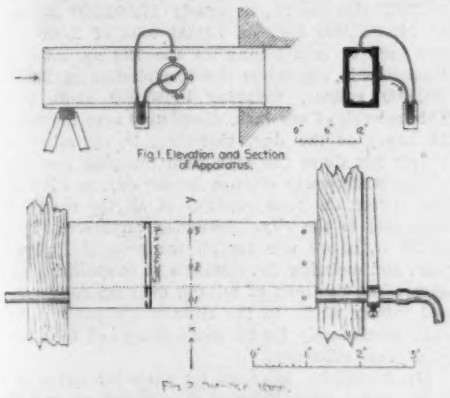
In response to an inquiry made of the United States Weather Bureau at Des Moines, Iowa, which has paid some attention to Mr. Jewell's experiments, unqualified disbelief is expressed in Mr. Jewell's ability to produce rain. The opinion of the department is concisely summed up in the "Monthly Review of the Iowa Weather and Crop Service," as follows:

> The weather bureau has enough evidence on this subject to justify the conclusion that no rain whatever has thus far been produced, or induced, by the so-called rainmakers. Every rainfall claimed by them, thus far, has turned out to be a natural rain, the probability of whose occurrence could have been foreseen by the help of the daily weather map.

A statement similar to the one just quoted is made by the officials of the United States Weather Bureau at Washington, D. C., and by Mr. B. E. Fernow, Chief of the Division of Forestry, U. S. Department of Agriculture. The foregoing comprises all the evidence we have been able to collect so far, and we present it for what it is worth.

RECENT EXPERIMENTS ON WIND PRESSURE.*

The subject of wind pressure is one on which our knowledge at the present day is not only limited, but exceedingly vague, and carefully-made experiments, if but to investigate a single feature of the problem, are, therefore, of the greatest interest, and can hardly



Figs. 1 and 2. Apparatus for Measuring Wind-Pressure and the Resultant Vacuum.

fail to add something new to our information. Mr. J. Irminger, C. E., Member of the Danish Society of Engineers, has determined what it is believed no one before him has attempted to do, the amount of suction produced by a current of air striking a plane surface, or the surfaces of various bodies; and the results of his experiments form the subject of a paper with the above title, read before that society in the early part of last summer. These results are remarkable by showing how very large a percentage of the total effect this suction is, not only through its action on the leeward side, but on the windward as well. In fact, when the angle at which the wind strikes a plane surface is small, nothing but suction is produced.

The practical importance of these experiments are evident; they throw considerable light upon the subject of flight, which at present is engaging so much attention; and in structural designing they point out the way to more rational methods. We have hitherto considered the resultant of the pressure only, but if that of the suction is also taken into account, the final resultant is changed both in amount and direction. Thus in the case of a roof, given below, the resultant of suction and pressure will tend to lift, and not overturn it, which is in accordance with experience. In the following abstract the

*Abstracted from "Ingenioeren," by O. J. Marstrand, M. Am. Soc. C. E.

method used by the author for a plane surface is described, and the results obtained for various other surfaces are given; the paper describes all methods in detail, but they are essentially alike in principle, and are, therefore, omitted here.

In opening his address, the author refers to the different existing formulas for determining wind pressure, which do not agree one with the other, and

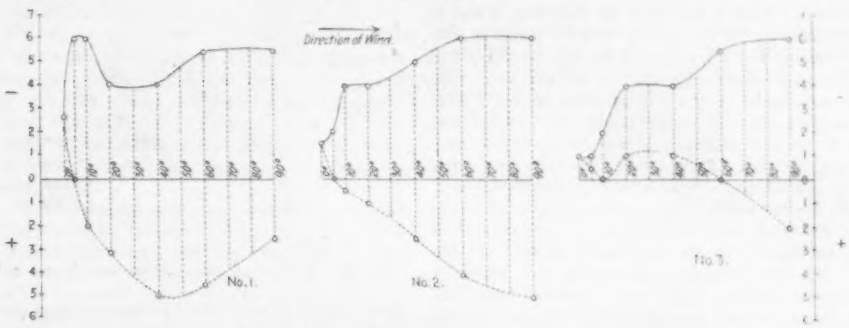


FIG. 3. WIND-PRESSURE DIAGRAMS.

only show the uncertainty that exists on the subject. He also refers to the recent experiments of Prof. S. P. Langley, who, among other things, determines the pressure vertical to the surface, and finds it to be much greater than expected in the case of small angles; the Professor does not, however, offer any explanation of this fact. Professor Raymond, of Berlin, in a lecture on Lilienthal's flying experiments, mentions a theory advanced by the latter, that the force which sustains the bird is due to the upward action of winds inclined to the horizon, at an angle of 3° to 4°. Raymond himself gives no other explanation, although he seems to doubt this one. He says, however, that the effect is the same as though such winds really existed. The theory that the effect of the wind, when passing over a surface at a small angle, is largely one of suction, has first been advanced by H. C. Vogt, C. E., and demonstrated in several articles in "Teknisk Forenings Tidsskrift," in 1889 and 1893, when he investigated its action upon the sails of ships and the wings of birds, and maintains that it is chiefly due to suction on the leeward side. His ideas were not, however, generally accepted; it was still believed that the pressure was due to the action of the wind on the windward side, although it could not be explained why it should, at angles so small as 5°, form so great a part (1-7) of the normal pressure; that is, the pressure upon a surface perpendicular to the direction of the wind. The practical interest attached to the subject then led the author to make experiments of his own, with a view of determining the suction produced. Naturally, he finds also the value of the total effect, made up of pressure and suction, and this incidental result enables him to compare his values with those determined by Professor Langley, and deduced from the various formulas.

The apparatus used is shown in Fig. 2. It is a small rectangular body, made of two thin iron sheets, about 4⅝ ins. long by 1⅝ ins. wide, and about 1-16 in. apart. Through the front edge is a hollow brass stem, or axis, closed at one end, and connected at the other with a pressure gage; the axis communicates with the interior through a couple of holes. There are two rows of holes, three holes in each row on the upper surface; one row is at the center, another near the edge. Through these holes the effect of the wind, whether pressure or suction, is transferred to the gage, care being taken that the edges of the holes are perfectly smooth. If the pressure at any one hole is to be measured, the others are closed with courtplaster, and thus the effect near either edge, or at the middle of the surface, may be separately determined. This apparatus is then enclosed in a box, shown in elevation and section in Fig. 1. This box is smoothly polished on the inside, and in order to secure a constant wind current, it communicates at one end with a large chimney, serving a number of gas ovens, and in such a manner that the draft can be easily regulated; moreover, the observations were made during calm weather. The effect of suction in the box was eliminated by making a hole directly over the apparatus, and then making a connection with the other branch of the water-pressure gage, as shown. An arm parallel to the plane, and attached to its axis, moves over a graduated circle on the outside of the box. The holes are on the upper side of the plane, when it is turned from the wind; and the effect of the wind on the windward or leeward side of the plane may be determined by turning the arm an equal angle above or below the zero point on the scale.

Observations were made at 0°, 5°, 10°, 20°, 40°, 60° and 90°, by turning the arm from 0° to +90° or from 0° to −90°; and the normal pressure determined at +90°. In Fig. 3 is shown, graphically, a single series of experiments; the three diagrams corresponding in numbers to the holes on the plane. The number of degrees, showing the inclination of the plane to the wind, is marked on a horizontal line, while the ordinates indicate the pressure as recorded by the water gage in units of about 5-64 in., suctions being negative and above the axis, while the pressures are positive and below the same. The full lines show the amount of suction on the leeward side; the dotted lines the pressure (or suction) on the windward.

It appears at once from these diagrams how large

TABLE I.—General Results of Experiments and Comparison with Results Obtained by Other Experimenters.

	1.		3.	4.	5.	Langley's experiments □ plane.	1st series Irminger's experiments planes long and narrow.		2d series Irminger's experiments planes short and wide.	
	$P_a = P \sin^2 a$	$P_a = P \sin a$	$P_a = P \frac{\sin a \, 1.84}{\cos a + 1}$	$P_a = P \frac{2 \sin a}{1 + \sin^2 a}$	$P_a = P \frac{(4 + w) \sin a}{4 + w \sin a}$	$\frac{P_a}{P}$	$\frac{P_a}{P}$	Effect suction on leeward side, p. c. total effect.	$\frac{P_a}{P}$	Effect suction on leeward side, p. c. total effect.
5°	0.008	0.087	0.131	0.17	0.146	0.15	0.23	100	0.12	100
10°	0.030	0.174	0.241	0.34	0.273	0.30	0.45	87	0.26	100
15°	0.067	0.259	0.350	0.48	0.384	0.46	0.47	85	0.41	100
20°	0.117	0.342	0.457	0.61	0.481	0.60	0.48	83	0.32	94
25°	0.179	0.423	0.563	0.72	0.567	0.71	0.53	79	0.59	88
30°	0.250	0.500	0.663	0.80	0.641	0.78	0.60	75	0.65	83
35°	0.329	0.574	0.754	0.86	0.706	0.84	0.67	71	0.69	78
40°	0.413	0.643	0.834	0.91	0.763	0.80	0.75	67	0.74	74
45°	0.500	0.707	0.901	0.94	0.812	0.93	0.80	66	0.78	70
50°	0.587	0.766	0.952	....	0.854	....	0.84	65	0.82	66
55°	0.671	0.819	0.989	....	0.890	....	0.87	64	0.86	61
60°	0.750	0.866	1.012	....	0.920	....	0.90	63	0.90	56
65°	0.821	0.906	1.022	....	0.945	....	0.93	62	0.93	53
70°	0.883	0.940	1.023	....	0.965	....	0.95	62	0.95	51
75°	0.933	0.966	1.018	....	0.981	....	0.97	61	0.96	49
80°	0.970	0.985	1.011	....	0.991	....	0.98	59	0.98	47
85°	0.992	0.996	1.003	....	0.998	....	0.99	58	0.99	46
90°	1.000	1.000	1.000	....	1.000	....	1.00	57	1.00	45

a percentage of the total effect the amount of suction is, and that it is particularly important at small angles. By combining the three diagrams, the pressure throughout the whole width of the surface is obtained, and it will be observed that the wind, blowing upon a surface at an angle of 0° to 5°, produces nothing but suction, on the windward as well as on the leeward side, while at 5° the suction on the windward side passes through zero to become a pressure. This is the case for diagrams 1 and 2, if not quite so for 3; but the general result is that the effect of the wind upon a surface at this small inclination is practically due to suction only. Experiments made for the row of holes near the edge of the plate gave the same results. The author also uses a shorter plane, 2½ ins. long, which does not fill the box, thus giving the air free passage on the sides, and in this case he obtains different results for the row of holes in the middle and at the edge, and also different results, numerically, from those obtained with the long plane, which filled the box. The characteristic features of both series of experiments remain unchanged, however, and both show the important part performed by the suction, especially at small angles.

Both series of experiments are made at different velocities, from 24 to 48 ft. per sec., while the velocity is kept constant during each experiment. The results of each series are averaged and combined in Table No. 1, where the value of $\frac{P_s}{P^{90}}$ or the ratio of pressure vertical to the surface to the normal pressure is given for different angles, together with the value determined by Langley, and those derived from five different well-known formulas. As regards Formula 3, it may be remarked that it is due to Hutton, who made his experiments 100 years ago; the formula is now used in this country.

In comparing his own experiments to those of Professor Langley, the author remarks that Langley

	Pressure in a Horizontal Direction	Pressure on the Windward Side, % of Total Pressure.	Suction on the Leeward Side, % of Total Pressure.
	p	45	55
	0.95p	57	43
	0.79p	24	76
	0.57p	28	72
	0.25p	18	82
	0.59p	58	42
	0.42p	14	86
	0.71p	63	37
	0.3/ Normal Pressure on a Plane = Area of Circle	23	77

Table No. 2. General Results of Experiments Upon Bodies of Different Shapes

found the pressure to vary very much with the shape of the plane, and as Langley used a plane 1 ft. square, it is natural that the results of the author's second series should be closer to Langley's than those of the first. Moreover, the wind was variable during Langley's experiments, and his apparatus was subjected to twisting strains, for which he had to make a certain allowance. In spite, therefore, of the great care used, Professor Langley does not himself claim any great accuracy for his results, although, in the main, they must be taken as correct. The size of the plane does not seem to have much influence, as Langley's was about 40 times as large as that of the author. The formulas given are independent of either shape or size, which should be considered in estimating their values. Alongside the values of $\frac{P_s}{P^{90}}$ as determined by the author, is given the percentage of suction to the total effect; it will be seen that this percentage does not fall below 45%, or the maximum percentage of the pressure alone is not over 55%.

With this in view, the great pressure exerted

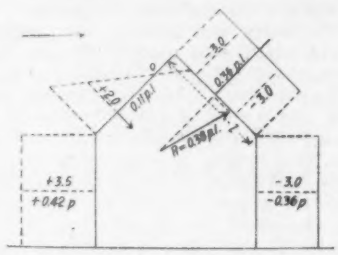


Fig. 4. Effect of Wind-Pressure Upon a Roof.

upon planes at even small angles can be understood. It is observed that the bird holds its wing at an angle of 6° with the horizon; at this inclination the effect of the wind upon the under side of the surface is zero, while the suction acting on the upper side is equivalent to an upward pressure which sustains the bird. Moreover, the friction of the medium through which the bird moves is hereby reduced, and a current is produced acting toward the wing, and inclined upward at a small angle. In windmills and sailing boats, where the sails are placed at acute angles to the wind, it will similarly be found that the propelling force is suction.

The author then continues his experiments by using bodies of different shapes. The method used is similar to that described for plane surfaces; the different bodies are hollow and made of thin sheet iron; they are about 4½ ins. long, and provided with three holes in a row in the middle of one side. A hollow axis passes through the center and communication is made with the pressure gage in the same manner as before. The results are given in Table 2; the total horizontal pressure is determined, p being the total pressure against a plane surface, the height of which is s; 45% of this total pressure is due to pressure on the windward side and 55% due to suction on the leeward. Similarly, the percentage of pressure and suction is given for the different bodies. In the case of the cylinder, which was examined by boring a single hole in it and revolving it gradually through 360°, it was found that pressure existed only between 0° and 35°, when the effect became a suction. Similar results were found for the sphere.

Perhaps the most important case investigated is the roof shown in Fig. 4, it was 2½ ins. long and sloped at an angle of 45%. It was made of thin sheet iron, a row of holes bored in the plane of the section and a hollow axis run through as before. The model was then placed in the box and communication made with the pressure gage. The normal pressure was first determined by placing a plane of the same dimensions perpendicular to the wind, and at a velocity of 42 ft. per sec. it was found to be 8.4 units on the water-pressure gage, each unit being roughly about 5-64 in. The pressure on the front side of the model was then found to be 3.5 units; on the front side of the roof surface +2.0 and 0.; suction on the rear side of the roof —3.0, and on the rear of the model —3.0. The means of the pressures on the two sides of the roof are, therefore, +0.9 and —3.0 units, and if the normal pressure, 8.4 units, is called p, the two pressures become 0.11 p and 0.36 p. These forces give, as shown, a resultant R = 0.38 p, or if the length of the roof is called l, R = 0.38 p l, inclined upward, and about 3.5 times as large as the pressure on the windward side alone. Another interesting experiment was made with a model of a building covered by a dome, in which case the resultant of pressure and suction upon the dome was shown to act vertically upward.

It is an easy matter to observe for one's self the phenomena investigated above. If, for instance, we hold two sheets of paper vertically and close to each other, and blow in between them, the sheets will be drawn together. If an egg is placed in a glass into which it fits, in such a manner that the smaller part of it is above the edge of glass, and we blow against it in a horizontal direction, it will be lifted out of the glass. An umbrella held vertically in the wind is drawn upward, and if the wind is strong enough the upward suction may turn it inside out. The author believes that by continuing these investigations much may be learned in regard to the action of the wind, which at present is not well understood. He refers to the case of the Louisville and Jeffersonville Bridge, which, it is claimed, was raised vertically from its supports and then carried 30 ft. to one side before it fell into the river. A bridge is usually calculated for a horizontal wind-pressure; if, however, the wind strikes it on the underside at an angle of 10° with the horizon, the upward suction amounts to 45% of the normal pressure. The important lesson taught by these experiments is that the wind acts in a direction quite different from that assumed, and usually provided for in the designing of bridges, roofs and other structures; the dead weight may not be sufficient to resist such action, and our attention is, therefore, called to the necessity of securing our structures more firmly to their supports.

THE WEIGHT AND POWER OF RAINFALL.

In discussing Mr. Jos. T. Richards' paper on the rebuilding of the Pennsylvania railway, after the Johnstown flood of 1889, made before the Engineers' Club of Philadelphia some time ago (Eng. News, Aug. 16, 1894), Mr. John Birkinbine and others gave some interesting data upon the weight and power of rainfall, which may be condensed as follows:

Few appreciate the actual volume of a heavy rainfall, and it is of interest to estimate this volume, as affecting some familiar area. One inch of rainfall on an area of one square mile is equivalent to 2,323,200 cu. ft., or nearly 17,500,000 gallons; or 145,200,000 lbs., or 72,000 tons of 2,000 lbs. One inch of rain falling on the 129 sq. miles of Philadelphia represents the precipitation of 2,250,000,000 gallons, weighing 9,365,000 short tons. This rainfall of one inch, distributed over the whole 24 hours of the day, therefore, is equivalent to nearly ten times the maximum pumping power of all the waterworks engines for one day, and is more than twice the total capacity of all the reservoirs belonging to the city. Assuming an average level of 84 ft. above tide for all the area of Philadelphia, and omitting the elements of evaporation and absorption, one inch of rainfall over the entire area and falling 84 ft. to the river would produce 190 HP. continuously for 24 hours if applied to motors of average efficiency.

Mr. Birkinbine has been for years interested in a study of the composition of the atmosphere and the work done by the sun in raising the moisture, which is afterwards precipitated in rain. In this connection, he says that Professor Loomis gives the average height of the clouds as about two miles above the earth, and as the aqueous vapor always present in the atmosphere is suspended for a considerable time and carried great distances by winds, it is highly probable that the mass of water falling as rain has been elevated by the sun to a height of, at least, 10,000 ft. But as the clouds discharging the rain are actually not more than half-a-mile above the earth, 3,000 ft. may be assumed in the following estimate: One inch of rain falling on one square mile weighs 145,200,000 lbs.; multiplying this by 3,000 ft. for the height and dividing by 60, on the assumption that this inch fell in one hour, gives us 7,260,000,000 ft.-lbs. as the amount of stored-up work which is delivered per minute in the falling of the rain on the above area. This work is equivalent to 220,000 HP. If pumping machinery were worked at the high economy of 2 lbs. of coal per horse-power per hour, and if the pumps gave a duty of 100,000,000 ft.-lbs., it would require 200 gross tons of coal to raise to a height of 3,000 ft. the water represented by one inch of rain over one square mile. If this quantity were multiplied by 129, the area of Philadelphia in square miles, it would mean a coal consumption of 25,800 gross tons and the development of 28,380,000 HP.

Mr. John E. Codman said that in the rainstorms of 1894, in Philadelphia, the following records were

made: On May 20-21, 5.13 ins. fell; 3.25 ins. of this in 24 hours; on May 28, 0.85 in. fell in 20 minutes. On the Perkiomen Creek, 6.29 ins. fell in 49 hrs. 20 mins.; and at the forks of the Neshaming, 30 miles from Philadelphia, 5.71 ins. fell in 54 hrs. 10 mins. The heaviest rain on record in the Philadelphia water department was that of June 6, 1893, when 1.20 ins. fell in 12 minutes, or at the rate of 6 ins. per hour. On May 20 and 21, 1894, the total rainfall at Quakertown was 15.02 ins.; at Germantown, 11.97 ins., and at Pottstown, 12.26 ins.

Mr. Edwin F. Smith said that flow-off observations made over a considerable period and area in Pennsylvania show a minimum run-off of 0.15 cu. ft. per second per sq. mile, and a maximum of 70 cu. ft. per second per sq. mile. A rainfall of 11 or 12 ins., distributed over a period of 48 hours, is an average condition for maximum floods. The famous flood of 1850 in the Schuylkill Valley followed a rainfall of 12½ ins. in 24 hours.

UTAH ASPHALT FOR PAVING.

The state of Utah has a variety of asphaltic mineral deposits ranging from semi-fluid asphaltum to rock asphalt, and several of these are being worked more or less extensively. Professor Kemp, of the Columbia College School of Mines, writing in the "Engineering and Mining Journal," in 1892, stated that asphaltic sandstones and limestones were found in different parts of the state, containing about 10% asphaltum, and of such composition that when crushed and heated they could be tamped directly into a pavement either with or without the addition of bitumen. During the last quarter of 1891 the Wasatch Asphaltum Co. shipped 800 tons of asphaltic limestone from its mines, valued at $18 per ton; and also shipped 500 tons of mastic, valued at $30 per ton, all of which was sent to Eastern cities for paving purposes. The rock was said to closely resemble the Val de Travers rock asphalt from Switzerland, but containing a higher percentage of asphaltum, and this rock when crushed and heated was used directly as paving material without admixture of any other ingredients. For export purposes, blocks of mastic were made, containing 35% asphaltum, these blocks being melted and from 100 to 300% of clean sharp sand being added to the mastic. This was said to contain no ingredients volatile at less than 300° F. The asphalt deposits of the Uintah Indian Reservation of Utah were the subject of controversy in 1893, the American Asphalt Co. having obtained from the Indians an agreement to lease the lands, which agreement the Secretary of the Interior at first refused to ratify, but approved later on. The company then leased 5,000 acres of mineral lands, the lease to terminate when the lands are thrown open to settlement. The consideration to be paid was $1 per ton for all asphalt mined (which might be increased to $2.50 at the discretion of the Secretary of the Interior) and a royalty of 15% of the value of all other minerals incidentally mined.

The organization of a company to operate the lime-rock asphalt deposits in Utah was noted in the industrial notes of our issue of Jan. 17, and we are indebted to Mr. F. J. Picard, of Columbus, O., for some further particulars as to this asphalt. An analysis of the asphalt, made in January by Professor Weber, of the Ohio State University, gives 50.75% of soluble asphalt, 15.35% of insoluble asphalt, and 33.90% of very fine grained lime, and the following is a comparison of analyses of Val de Travers and Utah lime rock asphalt, the latter having been made by Professor Ogden, of Columbia College:

	Val de Travers.	Utah.
Asphaltum	9.5	29.8
Water	1.5	1.4
Ash	89.0	68.4

This rock asphalt forms the bulk of the wearing surface in the company's pavement, but its excessive richness is reduced by the addition of coarse sand, which prevents the surface from becoming slippery, while at the same time it does not depreciate the wearing quality of the asphalt. No refining process is needed. The matrix for use with the above is Gilsonite or uintahite, an asphalt gum, which is another Utah product, and of which two analyses are given below, one made by Professor Drown recently, and the other, by Professor W. P. Blake, taken from a paper in the Transactions of the American Institute of Mining Engineers, vol. XVI., 1887-88:

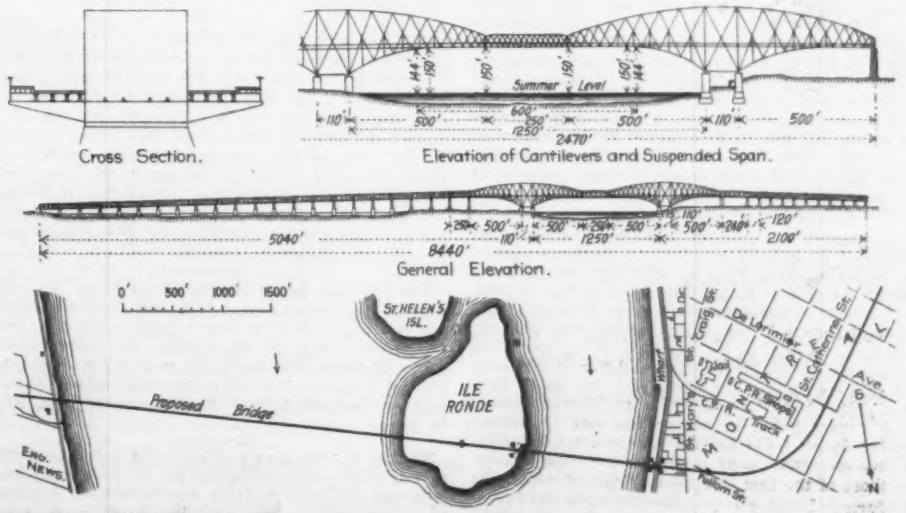
	Prof. Drown.	Prof. Blake.
Carbon	80.88	78.43
Hydrogen	9.76	10.20
Nitrogen	3.30	2.27
Oxygen	6.05	8.70
Ash	0.01	0.40

In proof of the good quality of these two materials as a paving composition, a piece of asphalt 6 ins. square was cut from a sheet asphalt pavement and replaced with cold asphalt of the same kind, which, after being rammed into place, made so good a joint that the patch could not be distinguished.

The company will also manufacture asphalt paving blocks for streets with light traffic and for sidewalks, drives, stables, etc., the blocks being laid on 4 or 6 ins. of concrete for streets and alleys, or 6 ins. of rolled gravel or cinders and 1 in. of sand for other places. The blocks are rolled or stamped to grade and the joints filled with boiling asphalt heated to a temperature sufficient to melt the edges of the blocks, thus uniting them with the filler to form one continuous sheet of pavement. The entire surface is then lightly flushed with the hot asphalt and covered with white sand. The material will also be used in the manufacture of a subsoil drainage curb, and an asphaltic cement filler for the joints of brick, stone and wood paving. This filler has been tried with brick paving at Marion, O., as noted in our issue of Feb. 7, and was found to be pliable and tough even in very cold weather, while the common tar filler was brittle. Varnishes, roof coverings, etc., are also to be manufactured. The Assyrian Asphalt Co. will control the sale and use of the various materials in Illinois and the Western states, and the American Asphalt Co., of Columbus, O., will control it in the Eastern states. Mr. F. J. Picard, Henry S. Hallwood and W. E. Guerin are among the incorporators of this latter company.

THE PROPOSED MONTREAL BRIDGE.

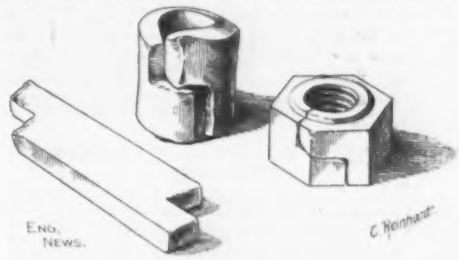
We are indebted to the courtesy of Mr. Walter Shanly, Chief Engineer of the Montreal Bridge Co., for the accompanying general location and design of the bridge which it is proposed to erect over the St. Lawrence River, at Montreal. The dimensions here given are taken from a plan corrected by Mr. Shanly himself and differ somewhat from those on the blueprints originally sent out to prospective bidders. It is understood that engineers and bridge-builders are to make their own designs for the superstructure, provided that their designs conform to the general requirements of span and clear height above water here indicated.



GENERAL DIMENSIONS OF THE PROPOSED BRIDGE ACROSS THE ST. LAWRENCE RIVER AT MONTREAL.

THE ELASTIC NUT.

The number and variety of devices in the way of lock nuts are so great that the chances of anything very novel in this line appear to be pretty small, but the "elastic" nut, illustrated herewith, is something out of the beaten path and appears to have already established itself as a success. The nut is made of spring steel, cut from a bar, and having the ends shaped so that they form a dovetail or halved joint when brought together by bending the flat strip into a ring. The rough ring is then pressed into hexagon shape, the height being reduced in the



The National Elastic Nut.

operation, and is then ready for tapping. The nut is tapped slightly smaller than the bolt, so that when it is put on with a wrench it opens about 1-64 in. at the joint and a clasp or grip on the bolt is thus developed, the fiber of the metal running around the nut. If the ends at the joint are cut at an angle this initial opening of the nut will also set up a lateral pressure on the threads of the bolt. The nut can be slackened and screwed up, and used over and over again, the grip causing no injury to the threads of either nut or bolt. The nuts are used in machine and track work. The National Machinery Co., of Tiffin, O., reports satisfactory results with a single elastic nut on wire-nail machines, where two common nuts would jar loose, while Mr. Edwin Reynolds, Superintendent of the Edward P. Allis Co., of Milwaukee, Wis., states that the nut yields slightly under severe strain, but when slackened up still retains a grip on the bolt sufficient to prevent it from jarring loose or working off the bolt by any jar or concussion occurring in machinery where nut locks are a necessity. The nuts are in use on the Baltimore & Ohio R. R., Chicago & Northwestern Ry., Lake Shore & Michigan Southern Ry., etc., and on the latter road are used in the yards at Cleveland and Toledo and on crossings on the Indiana Division, on which they have had hard usage, but have not worked loose. Some of the nuts have also been tried with good results on the Netherlands State Railways, of Holland. The cost is said to be but little more than that of the common nut, and to be less than that of a common nut with washer or nut lock. The nut is manufactured by the National Elastic Nut Co., of Milwaukee, Wis.

LEGAL DECISIONS OF INTEREST TO ENGINEERS.

Liability for Negligence in Defective Sewers.

Municipal corporations are liable in damages for the results of their negligence only in adopting defective plans for public improvements, and not for the results of an error in judgment. Negligence will not be inferred as a matter of law from the fact that culverts are defective in plan, and become obstructed and filled with dirt and sand.—City of Peru v. Brown (App. Ct. of Ind.), 38 N. E. Rep., 222.

Ownership of Submerged Lands.

The Supreme Court of Indiana holds that where a section of land is partly within and partly without a meander line, but the survey shows the four section corners, and runs the north and south line across a lake, a patent describing the section by its numbers conveys the whole of the section. The term "fractional," as used in describing a section of land partly within and partly without a meander line, refers simply to the circumstance that the section does not contain 640 acres of dry land, and does not bound the same by the meander line.—Tolleston Club of Chicago v. State, 38 N. E. Rep., 214.

Interpretation of Contract as to Conditions and Warranties.

A contract for furnishing storage-battery equipments for street cars, after specifying the machinery, terms of payment, and various stipulations, further provided that "the plant will be considered satisfactory if it fulfills the following conditions." Among the conditions enumerated were that each car should run 12 miles an hour over a suitable track, carrying 50 passengers; that with additional battery cells it should draw a trailer, loaded to a given weight; that a set of batteries once fully charged should propel a car 25 miles, etc. It was held that these provisions were not merely conditions under which the vendor might compel the acceptance of the equipment, and which were waived by an acceptance, but were warranties, for the breach of which damages could be recovered.—Accumulator Co. v. Dubuque St. Ry. Co. (Circ. Ct. of App., 8th Circ.), 64 Fed. Rep., 70.

Water Rate Not a Lien on Real Estate.

Judge Bradley, in the court of the District of Columbia, has ruled that a water rate is a charge against the occupier of a house and not a lien on the property itself. A tenant vacated a house leaving his water rates unpaid and his rent in arrears. The owner secured another tenant later; but the water commissioners refused to turn on the water until their bill was paid, claiming that this bill was a charge against the premises. Judge Bradley ruled that if this claim was sustained it made the accumulated charges a lien on the property, which was not the law. The law stated that the commissioners should be paid one year in advance from July 1 of each year for water, and permitted them to cut off the water if not paid within 30 days and to charge $2 for turning it on again. He further ruled that such charges were against the occupants of the premises for the time and not against the property itself. If the owner pays for the balance of the year, dating from the occupation by the new tenant, and the $2 penalty, he will then be entitled to have the water turned on.

The prices paid for armor plate form the subject of a recent communication of the Secretary of the Navy to the U. S. Senate. These prices are as follows: For American ordinary armor plate, $500 to $575 per ton; for "special" armor, $600 to $725; cost of treating by Harvey process, $61.60 per ton additional. The "compound" armor, purchased at Sheffield, England, for the "Miantonomah," is said to have cost $535 per ton. The nickel-steel armor made in the United States contains 3.25% of nickel; that made abroad contains from 2 to 2.25%. The Secretary calls attention to the fact that foreign armor is made in various grades and of various prices, and that the bids of English and French armor manufacturers for armor for foreign use are much lower than for armor for ships of their own nationality. The contracts with the United States makers are more severe in many respects in their requirements for acceptance than those abroad.

According to a statement made by Representative Harris, of Kansas, in a speech in Congress against the Pacific Railway Funding Bill, the twenty members of the firm of R. M. Shoemaker & Co., in 1865, made $85,000 profits each in building 135 miles of the Kansas Pacific Ry." Mr. Harris spoke from personal knowledge, he said, as he was then in charge of the construction of the Leavenworth division of the same road. He stated that the actual cost was about $16,000 per mile; but by means of the $250,000 of Leavenworth County bonds issued, by the sale of 223,000 acres of Indian lands donated by the state, by $600,000 first mortgage bonds placed on the road and by the land grants, the enormous profits of $1,700,000 were realized from a total expenditure of $2,160,000. He claimed that the construction company referred to was made up of the officers and directors of the railway company.

Progress on the Trans-Siberian railway is reported by U. S. Consul General Charles Jonas to Oct. 24, 1894. He describes the country through which it is located as mainly agricultural; mostly low land, with an alluvial soil and an average temperature of 60° F. between May and October. Western Siberia, comprising the two governments of Tobalsk and Tomsk, covers 871,000 sq. miles, or not quite one-fifth of the area of Siberia, but includes two-thirds of the total population, with an average of three persons per square mile. The western section of the railway, the 500 miles between Cheliabinsk and Omsk, was finished last summer, and in September, 1894, trains began to run at intervals. Passenger trains leave Omsk twice a week, and the fare for the 500 miles is $5.40 and $2.70 for third and fourth-class passage. The railway distance from Omsk to St. Petersburg is about 2,128 miles, and it takes 4½ days, as Russian trains run, to make the journey; the Asiatic boundary is reached in 2 days 4½ hours from St. Petersburg. From Eastern Russia more than 180,000 emigrants passed into and settled in the agricultural part of Siberia during last summer. Even at the present stage of development it is estimated that this western section of the railway will haul 15,000,000 bushels of wheat grown in Siberia, and the future possibilities can be guessed at from the fact that the richest government land is offered at a yearly rental of about $2.25 for 40 acres, and the wages of farm laborers range from 19 to 28 cts. per day, according to season.

A new style of car vestibule with trap doors has been applied by the Wagner Car Co. to a number of cars on the New York Central R. R. The vestibule is the full width of the car, the door being flush with the side of the car, and when the doors are closed trap doors shut down over the steps so as to increase the width of the platform.

The ventilation of the London underground railways is to be investigated by the London County Council. As the London "Engineer" says, it is quite time somebody did this.

An electric mail-carrier has been devised by Mr. Richard E. Sherman, of Chicago, and arrangements are being made for a test of the apparatus under permission granted by the Chicago Council. While he does not yet fully explain his scheme, Mr. Sherman proposes to carry the mail in a cylindrical car suspended from and traveling upon a cable carried over the buildings. He claims to have discovered a method of dispensing with a return wire and storage batteries in operating the car. He expects a speed of 60 miles per hour for a distance of 100 miles and estimates the cost of a completed mile of line at $250. The scheme is intended for the distributing of mail to suburban districts and towns. It is claimed that inclines of 20% can be surmounted.

Plans for two powerful steam ferryboats, for use in the Trans-Siberian railway crossing of Lake Baikal, have been prepared by the Craig Shipbuilding co., of Toledo, O. The designs are similar to those for the Toledo, Ann Arbor & No. Michigan Ry. car transfer steamers illustrated in our issue of June 15, 1893, and designed especially for regular service through heavy ice. The designs were prepared at the request of the two Russian engineers whose arrival in this country was noted in our issue of Jan. 3. They have now sailed for Europe with the plans, and will submit them to the directors of the Trans-Siberian Railway Co.

The Lartigue single-rail system of railway has been adopted on a short line recently completed in France. The cost of construction is put at $3,100 per mile, as against $4,600 per mile bid for a meter gage line. The 28-lb. carrying rail is carried on the top of A frames 3 ft. 3 ins. high, guide rails being attached to the sides of the frames. The cars straddle the track, like pack saddles, passengers sitting with their backs to the track. This line and another in Ireland are operated by steam locomotives, but horse traction has been applied to light railways of the same construction in Algeria and Russia.

The tug "El Toro," of the Morgan line, was 351 days in commission during 1894, and showed an average coal consumption of only 1 1-6 tons per day. The full pressure of steam was kept on the boiler for the entire 24 hours, and the boiler was run four months without opening. The vessel has quadruple-expansion engines, designed by Mr. Horace See, M. Am. Soc. M. E.

By July 1, 1895, says a Washington item, the 20,000 tons of armor-plate contracted for by the former Secretary of the Navy Whitney will have been delivered to the government. The total cost to the government will approach $12,000,000. About one-third of this armor is Harveyized, and the inventor of this process is said to have received about $100,000 in royalties.

International St., in the town of Nogales, Ariz., is 120 ft. wide, with 60 ft. of the street lying on each side of the boundary line between the United States and Mexico. On the American side property owners have encroached upon the street, and a number of buildings, including the station of the New Mexico, Arizona & Senora Railway, are located upon the street. The International Boundary Commission has now ordered a resurvey and the removal of these structures.

The total cost of the English Ordnance Survey, says the London "Quarterly," has been figured at between $250 and $260 per square mile. This includes primary, secondary and tertiary triangulation, levelling, surveying, engraving, publishing, and all the necessary expenses. It also includes a large number of "town plans," on a scale of 1-500, costing at the rate of from $4 to $5 per acre. In this total cost is also the whole cost of the 1-in. topographical map. The normal cost of the 1-2,500 survey was about $0.24 per acre.

An iron roof built over a stone arch railway bridge, to protect it from the rain, is a novelty. Yet such a structure may be seen over a stone arch of 146 ft. span and 42 ft. rise on the Gorlitz-Dresden Railway. The arch was built in 1845 of sandstone rings, backed by rubble. In wet weather this arch was found to be completely saturated, and an examination made by sinking two wells in the backing showed loose stone and quite soft mortar. As this Saxon sandstone is considerably reduced in strength by wetting, the alternative course was presented of rebuilding the arch, or of keeping it dry. Plans for drying it by a layer of concrete and for rebuilding in iron were rejected on account of cost, and a roof of galvanized corrugated plate was finally built over it, at a cost of $4,800.

The tests of Melan floor arches noted last week were continued on Feb. 1, and the arch which was under test Jan. 25, when the testing machine clamps broke, was again loaded and sustained 6,530 lbs. per sq. ft., when one of the tiebars failed. This arch was then broken down with a maul, which required very hard work, the cement being strong and tough throughout. In another test the tiebars were bent, and finally the clamps broke again under the enormous pressures required to destroy the arches, so that it is difficult to give any reliable figures as to the actual breaking loads of these arches, and further tests are therefore to be made. A 4-in. concrete arch, 6 ft. span and 3 ft. wide, without any iron ribs, broke at 30,000 lbs. (1,666 lbs. per sq. ft.), and a similar arch with a rib at one side (the concrete having cracked away from the other rib) carried 58,750 lbs. (3,264 lbs. per sq. ft.).

Eggette fuel, or pulverized culm mixed with a binder and pressed into pieces about the size of eggs, has been tried with satisfactory results for fire engine fuel at Denver, Colo. The material was made from the screenings of Colorado lignite, and was found to raise steam very rapidly.

A cable line from the United States to Hawaii is provided for in the consular and diplomatic bill presented to the U. S. Senate with an appropriation of $500,000 as a part of the cost.

The Manchester ship canal, says the English "Statist," is hopelessly bankrupt. This financial journal says that the share capital now amounts to $40,000,000 and the loans to $12,500,000 of 4% and $22,500,000 of 4½%. Including $20,000,000 of preferred shares at 5%, the mere annual interest charge is $2,512,500. This leaves out of account the $2,500,000 which the company still has power to borrow, and also the provision for the sinking fund, depreciation, etc. The "Statist" suggests that the city of Manchester alone can reduce this charge, and as that city is said to be greatly benefited by the canal, it proposes that Manchester reduces its interest on the $22,500,000 invested by it from 4½ to 3½%. This would at once make a saving of $225,000 a year without loss to the city. The opinion is growing in England that ultimately the canal will have to be taken over by some public trust, issuing bonds secured by taxes on all the area benefited by the construction of the canal.

A ship canal connecting Newtown Creek and Flushing Bay, Long Island, is being again discussed. This is an old scheme, proposed by Governor De Witt Clinton as a means of reaching Long Island Sound from the East River without encountering the dangers of Hell Gate and its vicinity. Another object of the promoters is to secure a flow of water through Newtown Creek and thus abate the nuisances long existing there. The promoters want the State to build the canal, but no estimates of cost are yet submitted.

The cost of Chicago street paving in 1894 was considerably less than in 1893. According to the report of the Commissioner of Public Works, the relative expense was as follows: The cost per square yard of cedar block pavement was $1.12 in 1893, $0.79 in 1894; macadam, $0.90 in 1803, $0.70 in 1894; granite, $3.00 in 1893, $2.84 in 1894. This is an aggregate, on about 1½ million square yards, of 27.3% in favor of 1894. The saving in asphalt pavement was about 34.6% over the cost of 1894. The average price paid for curbing in 1894 shows a saving of 15% over 1893, partly due to the use of Bedford stone introduced during the year. Reduced prices for labor and materials account for the changes, says the Commissioner.

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PERSONALS.

Mr. T. Howard Barnes has been elected City Engineer of Medford, Mass.

Mr. R. B. Cable has resigned his position as General Manager of the Florida Southern R. R.

Mr. J. J. Smith, of the car-heating firm of Van Sandt & Meeds, Cincinnati, O., has retired, and the firm remains as above.

Col. Cyrus B. Comstock, M. Am. Soc. C. E., U. S. Engineer Corps, stationed in New York, has been placed on the retired list.

Mr. George M. Lehman, of Philadelphia, Pa., has been appointed engineer to make surveys for the proposed Erie & Ohio River Canal.

Mr. Wilbert Irwin, Superintendent of the Texas Midland R. R., fell from a train near Terrell, Tex., Feb. 5, and was killed.

Mr. H. A. White, Division Superintendent of the Chicago, Rock Island & Pacific Ry., died at Trenton, Mo., Feb. 7, at the age of 52.

Mr. George A. Burt, of New York, has been appointed General Manager of the Ohio River R. R., with offices at Parkersburg, W. Va.

Mr. William Brookfield was appointed Commissioner of Pubic Works by Mayor Strong, of New York, on Feb. 13, to succeed Mr. Michael T. Daly.

Lieut.-Col. George L. Gillespie, U. S. Engineer Corps, has been appointed a member of the Mississippi River Commission, vice Gen. Comstock, who has recently been retired.

Mr. W. B. Ott, Assistant Engineer on the Philadelphia, Reading & New England R. R., has been appointed Assistant Roadmaster, with office at West Winsted, Conn.

Mr. E. E. Davis, Superintendent of the Boles Steel Wheel Co., of Scranton, Pa., has been appointed Assistant Superintendent of Motive Power of the Philadelphia & Reading R. R.

Mr. H. O. Pond, formerly Superintendent of the Columbus, Sandusky & Hocking R. R., has been elected Vice-President and General Manager of the Ohio Sand & Clay Co., of Columbus, O.

Mr. Edward D. Sancton, formerly Superintendent of the Dickson Mfg. Co.'s works at Scranton, Pa., has gone to England as Assistant to the Managing Director of Fraser & Chalmers works at Erith.

Mr. Edwin H. Mead, Managing Director of the Erie & Wyoming Valley R. R., President of the Pennsylvania Coal Co., and a prominent operator in the coal trade, died at South Orange, N. J., Feb. 3, at the age of 73.

Mr. Charles A. Alderman, City Engineer of Eau Claire, Wis., has removed his office from the City Hall, and opened an office in the new Chippewa Valley Bank Building, for general practice in civil, municipal and railway engineering.

Mr. Clarence Coleman, civil engineer, of Roanoke, Va., and late Engineer Member of the Board of Public Works of that city, has been appointed U. S. Assistant Engineer under Major Clinton B. Sears, U. S. Engineers, and will have charge of the construction of a concrete superstructure for the breakwater at Marquette, Mich. on Lake Superior.

Mr. Eugene L. Maxwell, of the New York firm of Manning, Maxwell & Moore, dealers in railway supplies and machinery, died in Brooklyn, N. Y., Feb. 9, at the age of 42. He was President of the Pond Machine Tool Co., of Plainfield, N. J., and the Ashcroft Mfg. Co., of Bridgeport, Conn., and Vice-President of the Shaw Electric Crane Co., of Muskegon, Mich.

Mr. A. Dolbeer, formerly Master Mechanic of the Lehigh Valley R. R., and later of the Buffalo, Rochester & Pittsburg R. R., has been appointed Superintendent of the Boles Steel Wheel Co., of Scranton, Pa., vice Mr. E. E. Davis, resigned, to go to the Philadelphia & Reading R. R. as Assistant Superintendent of Motive Power.

Mr. Herman Gruson, head of the Gruson foundry works at Buckau, Germany, died at Magdeburg, Germany, Jan. 31. He was born at the latter place in 1821, and in 1868 he established a gun foundry at Buckau, where Hotchkiss rapid-fire guns were manufactured for the German army. He paid particular attention to the manufacture of chilled cast iron armor plates for shore batteries, tests of which were described in our issues of Jan. 9, 16 and 23, 1886, and April 30, 1887.

Messrs. Albert F. Noyes, M. Am. Soc. C. E., and Allen Hazen have opened an office at 83 Water St., Boston, Mass., under the firm name of Noyes & Hazen. A specialty will be made of water supply and sewerage, sewage disposal and filtration. From 1876 to 1893 Mr. Noyes was City Engineer of Newton, Mass., and since the latter date he has been Assistant Chief Engineer to the Massachusetts State Board of Health. Recently Mr. Noyes was appointed a member of the Metropolitan Sewerage Commission. Mr. Hazen was Chemist-in-Charge of the Lawrence Experiment Station of the Massachusetts State Board of Health from 1888 to 1893, was in charge of sewage treatment and water inspection at the World's Columbian Exposition, and spent the greater part of 1894 in studying, by personal inspection, water supply and water and sewage purification in Europe. Mr. Hazen now has in press a treatise on the "Filtration of Public Water Supplies."

Mr. Charles W. Copeland, M. Am. Soc. M. E., marine and mechanical engineer, died in Brooklyn, N. Y., Feb. 5. He was born at Coventry, Conn., in 1815, and worked at his father's engine and boiler works at that place. In 1836 he accepted the place of designing and constructing engineer of the West Point Foundry, of New York, at that time the foremost plant of its kind in this country, and while there he designed and built many marine engines, notably those for the U. S. naval steamer "Fulton," and several river steamers. He also built the first iron hull in the United States for a boat which plied on Lake Pontchartrain. In 1839 he was appointed constructing engineer to the Navy, an office similar to that now occupied by the chief of the Bureau of Steam Engineering. After this he became superintending engineer of the Allaire Works, of New York, where he designed and built the machinery for the Collins steamers "Pacific" and "Baltic;" also the "Panama" for the California business, and several Sound steamers. During the war he was largely engaged in altering and fitting steamers for the fleets engaged on shallow waters of the Southern rivers, and it was through his advice that many double-enders were brought into use for the intricate channels of those rivers. Since then he had been consulting and superintending engineer to the U. S. Lighthouse Board, generally designing and superintending the building of vessels for that service. He was a director of as well as consulting engineer to the Norwich & New York Transportation Co., and while in that service designed the steamers "City of New York," "City of Boston," and later the "City of Worcester."

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Feb. 13. "The Electric Motor in the Machine Shop." Secy., F. R. Hutton, 12 W. 31st St., New York city.
ENGINEERS' CLUB OF PHILADELPHIA.
Feb. 16. Secy., L. F. Rondinella, 1122 Girard St.
ENGINEERS' CLUB OF MINNEAPOLIS.
Feb. 18. Secy., E. Nexsen, Kasota Block.
COLUMBIAN ENGINEERING SOCIETY.
Feb. 19. Secy., W. F. Hart, Washington, D. C.
WESTERN RAILWAY CLUB.
Feb. 19. Secy., W. D. Crosman, Club Room 9, Grand Pacific Hotel, Chicago.
ASSOCIATION OF ENGINEERS OF VIRGINIA.
Feb. 20. Secy., J. H. Pilcher, Roanoke, Va.
ENGINEERS AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Feb. 20. Secy., F. Van Vleck, Los Angeles, Cal.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Feb. 20. Secy., S. E. Tinkham, City Hall. Rooms, 36 Bromfield St.
ENGINEERS' CLUB OF ST. LOUIS.
Feb. 20. "Mechanics of Soaring Flight," E. D. Meier. Secy., W. H. Bryan, Turner Block.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Feb. 20. Secy., Francis Collingwood, 127 E. 23d St., New York.
NEW YORK RAILROAD CLUB.
Feb. 21. Secy., John A. Hill, 256 Broadway, N. Y. City.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Feb. 21. Secy., D. Carhart, Carnegie Library Building, Allegheny.
ENGINEERS' CLUB OF CINCINNATI.
Feb. 21. Secy., J. F. Wilson, 24 W. 4th St.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Feb. 21. Secy., C. H. McLeod, 12 Mansfield St., Montreal.
FRANKLIN INSTITUTE, PHILADELPHIA.
Feb. 21. "Torpedo Artillery," Capt. E. L. Zalinski. Secy., W. H. Wahl, 16 South Seventh St., Philadelphia.
ENGINEERS' CLUB OF INDIANAPOLIS.
Feb. 23. Secy., C. C. Brown, City Engineer.
DENVER SOCIETY OF CIVIL ENGINEERS.
Feb. 26. Secy., F. Ed. King, 36 Jacobson Block.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Feb. 27. Secy., F. R. Hutton, 12 W. 31st St., New York.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Feb. 27. "Notes on Recent Electrical Engineering Developments in France and England," by H. W. Leonard. Secy., R. W. Pope, 12 W. 31st St., New York city.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
March 1. Secy., O. H. Von Geldern, 719 Market St., San Francisco.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
March 4. Secy., C. L. Annan, City Engineer's Office.
ENGINEERING SOCIETY OF WESTERN NEW YORK.
March 4. Secy., Geo. B. Sikes, 122 Pearl St., Buffalo, N. Y.
WESTERN SOCIETY OF ENGINEERS.
March 6. Secy., Chas. J. Roney, 1736 Monadnock Block, Chicago.
MONTANA SOCIETY OF CIVIL ENGINEERS.
March 9. Secy., G. O. Foss, Helena, Mont.
WISCONSIN POLYTECHNIC SOCIETY.
March 11. Secy., Geo. G. Mason, 144 8th St., Milwaukee.
ENGINEERS' CLUB OF KANSAS CITY.
March 11. Secy., F. W. Tuttle, Baird Building.
NORTHWESTERN SOCIETY OF ENGINEERS.
March 12. Secy., D. W. McMorris, Burke Building, Seattle, Wash.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
March 12. Secy., F. C. Osborn, 721 Hickox Building.
NORTHWESTERN RAILWAY CLUB.
March 12. Secy., W. D. Crosman, Ryan Hotel, St. Paul.
NEW ENGLAND RAILROAD CLUB.
March 13. Secy., F. M. Curtis, P. O. Box 1576, Boston, Mass.
ENGINEERS & ARCHITECTS' CLUB
March 14. Secy., Jas. K. Zollinger, Norton Building.
ENGINEERING ASSOCIATION OF THE SOUTH.
March 14. Secy., H. D. Ruhm, Nashville, Tenn.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
March 15. Secy., D. W. Meeker, St. Paul, Minn.
CENTRAL RAILWAY CLUB.
March 27. Secy., H. D. Vought, Buffalo "Courier," Buffalo, N. Y.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
April 18. Atlanta, Ga., Secy., F. A. Charlpiot, Macon, Ga.

ENGINEERING SOCIETY OF WESTERN NEW YORK.—This new society holds its regular meetings in Buffalo on the first Monday of each month. It has not yet selected permanent headquarters. The officers for 1895 are as follows: President, George E. Mann; Vice-Presidents, E. B. Guthrie and Walter McCulloh; Secretary, G. B. Sikes; Directors, Geo. B. Burbank and C. M. Morse.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—At the meeting on Feb. 6 a paper by Mr. Wm. Ham. Hall, on "The Santa Ana Canal of the Bear Valley Irrigation Co.," was presented. The canal is one part of extensive works, including also the Alessandro Canal, the Moreno Canal and the Moreno Tunnel, which later is 2,320 ft. long, and was constructed about five years ago. The works for the Santa Ana Canal include flumes, tunnels (one of which is lined with redwood staves), dams, and wooden pipe lines. The work was described in detail, and full particulars of the cost were given.

The announcement was made that the Board of Direction has appointed as Secretary Mr. Chas. Warren Hunt, who has been Assistant Secretary for two years past.

ASSOCIATION OF ENGINEERS OF VIRGINIA.—The annual meeting was held at Roanoke, Va., Jan. 26, the President, Mr. Chas. S. Churchill, in the chair. The reports showed a membership of 36 and a balance in the treasury of $158. It was announced that the association has joined the Association of Engineering Societies. A paper by Mr. J. E. M. Hanckel, on "Road Improvements in Knox County, Tennessee, and Fulton County, Georgia," was read and discussed. The election of officers resulted as follows: President, J. C. Rawn; Vice-President, M. E. Yeatman; Secretary, John A. Pilcher; Treasurer, Jas. R. Schick; Directors, Chas. S. Churchill, L. L. Randolph, and H. C. Macklin. Mr. Churchill was also elected as the representative on the Board of Management of the Association of Engineering Societies. J. A. Pilcher, Secy.

MASTER CAR BUILDERS' ASSOCIATION.—The secretary has issued a circular stating that on Oct. 17, 1894, the American Railway Association adopted the following resolution:

Resolved, That the "Details of Car Construction," adopted by the Master Car Builders' Association, as published with the proceedings of its convention, held at Saratoga in June, 1894, be and are hereby adopted as standard by the American Railway Association, and all railway companies and car builders are recommended to conform thereto as soon as practicable.

In accordance with the instruction of the M. C. B. Association last June, the Executive Committee took up the question of standards with the American Railway Association, and the result has been as above. Members are urged to consider the importance of following this matter up and taking up the standards of the Association with the proper officers of their respective companies and advocate their general adoption.

The Committee on Coal Car Sides has issued a circular asking for blueprints and particulars of the latest designs of coal car bodies showing in detail the method of leaving the sides. Replies to be sent to R. E. Marshall, Broad St. Station, Philadelphia, Pa.

ENGINEERS' CLUB OF PHILADELPHIA.—At the meeting of Feb. 2 a paper was read by Mr. V. Angerer on "Investigation and Experiments for the Determina-

tion of the Groove in Guard Rails for Street Railways." The paper described investigations made to determine the shape of groove best designed as to present from the start the largest possible wearing surface to the action of the wheels, and thus prolong the life of the rails, especially on railways operated by electric motors. Mr. Carl G. Barth presented a resume of his paper on "The Principles of Calculus in a New Light."

L. F. Rondinella, Secy.

INDIANAPOLIS ENGINEERING CLUB.—At the meeting on Feb. 9 a paper on "Art and Engineering" was read by Louis H. Gibson. He said that the architect who undertakes to be his own engineer in important structures, or the engineer who undertakes to be his own architect in structures requiring artistic attention, is not doing himself or his client justice. Much of the influence that makes architects constructors and not artists is due to the schools, which pay too much attention to the engineering side and relatively very little to the artistic side. The Ecole des Beaux Arts, in Paris, is the only school which educates architects as artists. The combination of the artist with the engineer and the business man in a firm makes a success, but the attempt to combine them in the individual results in failure.

Chas. C. Brown, Cor. Secy.

MINNESOTA STATE SURVEYORS AND ENGINEERS' ASSOCIATION.—This association has been organized for the purpose of securing uniformity in the records of the county surveyors, and the first meeting was held in St. Paul Feb. 8, at which the following officers were elected: Pres., N. Y. Taylor, of Litchfield; Vice-Pres., Gates A. Johnson; Secy., Charles A. Forbes. Mr. J. H. Armstrong, City Engineer of St. Paul, read a paper on the establishment of monuments in that city.

WESTERN SOCIETY OF ENGINEERS.—The regular monthly meeting of the society was held at Science Hall, Armour Institute, Chicago, Feb. 6. The entire session was devoted to the reading of papers describing the methods of construction on the Brighton and Summit divisions of the Chicago Main Drainage Channel by Mr. Alex. E. Kastl, M. Am. Soc. C. E., and Mr. E. R. Shnable, the engineers in charge of these two divisions. The papers were illustrated by stereopticon views provided by the Institute. The present headquarters of the society are at 1736-39 The Monadnock Block, Chicago.

ENGINEERS' CLUB OF ST. LOUIS.—At the meeting on Feb. 6 the further discussion of Mr. B. L. Crosby's paper upon "The St. Louis Extension of the St. Louis, Keokuk & Northwestern R. R.," read Dec. 19, was taken up, and Mr. Crosby exhibited a number of lantern slides, showing foundation work on the piers of the Sioux City, Nebraska City, Rulo and Bellefontaine bridges across the Missouri River, and the Alton and Memphis bridges across the Mississippi. The Morison clay hoist and sand pump were described in detail, as were also the details of the caisson work, and the use and construction of air-locks. Figures were given showing the cost of deep foundations at different places. The reading of Mr. Curtis' paper on "A System of Water Purification" was deferred until the next meeting, Feb. 20. Wm. H. Bryan, Secy.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.—At the regular meeting on Feb. 4 the report of the committee on the Minnesota Topographical Survey was read and accepted. Mr. Armstrong reviewed and illustrated three decisions of the U. S. Supreme Court in the matter of riparian boundaries, and Mr. Munster gave his theory of the reason of the failure to fall of two heavily-loaded spans of the University Ave. bridge after the destruction of the post common to the two by a derailed cattle train. C. L. Annan, Secy.

TECHNICAL SOCIETY OF THE PACIFIC COAST.—The election of officers for 1895 resulted as follows: President, Geo. W. Dickie; Vice-President, W. G. Curtis; Secretary, Otto von Geldern; Treasurer, Geo. F. Schild; Directors, Louis Falkenau, W. F. C. Hasson, Randell Hunt, J. D. Isaacs and Jos. C. Sala.

LIVERPOOL ENGINEERING SOCIETY.—At the meeting on Jan. 23 a paper was read on "The Theory and Action of Some Automatically Balanced Machinery," by Mr. W. Worby Beaumont, M. Inst. C. E., of London. He described the new system of design for coal and mineral screens, thrashing machines, concentrators and graders, according to which an automatic balance is secured. The apparatus was illustrated and described in our issue of Nov. 15, 1894.

NEW PUBLICATIONS.

BULLETINS OF THE OFFICE OF ROAD INQUIRY. Issued by the Road Inquiry Office of the Department of Agriculture, Washington, D. C. Roy Stone, Special Agent in Charge of Road Inquiry. Paper; 8vo.

Bulletin No. 1. State Laws Relating to the Management of Roads, Enacted in 1888, 1893. Compiled by Roy Stone, Special Agent in Charge of Road Inquiry, Pp. 95.

Bulletin No. 3. Improvement of the Road System of Georgia. By O. H. Sheffield, C. E., University of Georgia. Pp. 31.

Bulletin No. 4. Report on Road-Making Materials in Arkansas. By John C. Branner, Arkansas State Geologist. Pp. 11.

Bulletin No. 5. Information Regarding Road Materials and Transportation Rates in Certain States West of the Mississippi River. Pp. 24.

Bulletin No. 6. Information Regarding Roads, Road-Materials and Freight Rates in Certain States North of the Ohio River. Pp. 30.

Bulletin No. 7. Information Regarding Roads and Road-Making Materials in Certain Eastern and Southern States. Pp. 29.

Bulletin No. 8. Earth Roads; Hints on their Construction and Repair. Compiled by Roy Stone, Special Agent in Charge of Road Inquiry. Pp. 25.

Bulletin No. 9. State Aid to Road-Building in New Jersey. By Edward Burrough, Chairman of the New Jersey State Board of Agriculture and State Commissioner of Public Roads. Pp. 20.

Bulletin No. 10. Proceedings of the National Road Conference held at Asbury Park, N. J., July 5 and 6, 1894. Pp. 63.

Bulletin No. 14. Proceedings of a Convention of the National League for Good Roads held at Washington, D. C., Jan. 17 and 18, 1893; and Hearing by the Committee on Agriculture of the House of Representatives, Jan. 19, 1893. Pp. 101.

These official publications are an important educational feature in the movement for the improvement of public roads, and contain much valuable matter relative to road laws and road practice.

TRADE PUBLICATIONS.

HIGH DUTY PUMPING ENGINES.—The Holly Mfg. Co., Lockport, N. Y. 4to; pp. 79; illustrated.

This is a handsome and elaborate trade publication, but has the objectionable feature of awkward and unnecessary size, with excessively wide margins. Now that standard sizes have been adopted for trade catalogues, etc., manufacturers will consult their own interests by conforming to them, and thus making their publications easy to file for reference. There is nothing in the descriptive catalogue under notice which could not have been shown equally well in a pamphlet of the standard size. In other respects there is little to criticise and very much to praise in this publication. The descriptions of the various engines illustrated are fully complete. This company has now built 189 high-duty pumping engines, with a total daily capacity, at an average head of 100 ft., of 2,245,135,000 gallons. It has also built 255 pumping engines of other types, making a grand total of 454 engines in all. The closing pages of the volume contain several tables useful in water-works computations.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Feb. 15.	Stone dam	Holyoke, Mass.	Dec. 13
	Advertised, Eng. News, Dec. 13 to Jan. 24.		
Feb. 15.	Market house	Cincinnati, O.	Jan. 24
Feb. 15.	Electric wiring	Lafayette, Ind.	Jan. 31
Feb. 15.	Sewers	Sheboygan, Wis.	Feb. 7
Feb. 16.	Sewers	Cincinnati, O.	Jan. 24
Feb. 16.	Rock excav. (70-ft. shaft)	Wash'n, D.C.	Feb. 14
Feb. 18.	Removing boulders	Portland, Me.	Jan. 24
	Advertised, Eng. News, Jan. 24 to Feb. 14.		
Feb. 18.	Stone	Portland, Me.	Jan. 24
	Advertised, Eng. News, Jan. 24 to Feb. 14.		
Feb. 18.	Dredging	Norfolk, Va.	Jan. 24
Feb. 18.	Removal of ledge	Portland, Me.	Jan. 24
	Advertised, Eng. News, Jan. 24 to Feb. 14.		
Feb. 18.	Brick court-house	Rock Island, Ill.	Feb. 7
Feb. 18.	Brick paving	Ottumwa, Ia.	Feb. 7
Feb. 18.	Public building	Pittsburg, Pa.	Feb. 14
Feb. 19.	Torpedo boats	Washington, D. C.	Dec. 6
Feb. 19.	Hydraulic elevators	Washington, D. C.	Jan. 24
Feb. 19.	Plumbing at New York, N. Y.		Jan. 31
	Advertised, Eng. News, Jan. 31 and Feb. 7.		
Feb. 19.	30-in. wooden stave pipe line	Dallas, Tex.	Jan. 31
	Advertised, Eng. News, Jan. 31 to Feb. 14.		
Feb. 19.	Addition to U. S. print's house	Wash'n.	Jan. 31
Feb. 19.	Pumping engine, Oil City, Pa.		Jan. 31
Feb. 19.	Boilers	Buffalo, N. Y.	Feb. 7
Feb. 19.	School building	Bayonne, N. J.	Feb. 7
Feb. 19.	Hospital	Sandusky, O.	Feb. 7
Feb. 19.	Paving, Terre Haute, Ind.		Feb. 14
Feb. 19.	Supplies for Norfolk Navy Yard		Feb. 14
Feb. 19.	Telegraph wire (100miles)	Brooklyn, N.Y.	Feb. 14
Feb. 19.	Supplies for New York Navy Yard		Feb. 14
Feb. 19.	H'way bonds ($100,000)	Mt. Vernon, N.Y.	Feb. 14
Feb. 20.	Water bonds ($25,000)	Kamloops, B. C.	Jan. 10
Feb. 20.	Metal work, Portland, Ore.		Jan. 17
	Advertised, Eng. News, Jan. 17.		
Feb. 20.	Asphalt paving, Ottawa, Ont.		Jan. 17
Feb. 20.	Breaking rock, New York, N. Y.		Jan. 24
	Advertised, Eng. News, Jan. 24 to Feb. 14.		
Feb. 20.	Snagboat, St. Louis, Mo.		Jan. 24
	Advertised, Eng. News, Jan. 24 to Feb. 7.		
Feb. 20.	Clearing reservoir site, New York		Feb. 7
Feb. 20.	Steam pumps, St. Louis, Mo.		Feb. 7
	Advertised, Eng. News, Feb. 7 and 14.		
Feb. 20.	School houses, Providence, R. I.		Feb. 14
Feb. 20.	Brick sewers (672 ft.), Muscatine, Ia.		Feb. 14
Feb. 20.	Highway (1 mile), Steubenville, O.		Feb. 14
Feb. 20.	Brick paving, Muscatine, Ia.		Feb. 14
Feb. 20.	Dam and spillway, Annapolis, Md.		Feb. 14
Feb. 20.	Sewers, Cleveland, O.		Feb. 14
Feb. 20.	Buoys, Detroit, Mich.		Feb. 14
Feb. 20.	Dock work, Cleveland, O.		Feb. 14
Feb. 21.	Cast iron pipe, Newark, N. J.		Feb. 14
Feb. 21.	Grading seven streets, Cleveland, O.		Feb. 14
Feb. 21.	Piling, etc., at Leavenworth, Kan.		Feb. 14
Feb. 21.	Piling, etc., at Omaha, Neb.		Feb. 14
Feb. 23.	Pipe sewers, Elizabeth, N. J.		Feb. 7
Feb. 23.	Brick paving, Cincinnati, O.		Feb. 14
Feb. 25.	Macadamizing, Stapleton, N. Y.		Feb. 7
Feb. 25.	Iron bridge, Cincinnati, O.		Feb. 7
Feb. 25.	Court-house bonds, Waxahachie, Tex.		Feb. 7
Feb. 25.	Filling ravine, San Francisco, Cal.		Feb. 7
Feb. 25.	Building work, New York, N. Y.		Feb. 14
Feb. 25.	Paving, Dayton, O.		Feb. 14
Feb. 25.	Brick paving, Waterloo, Ia.		Feb. 14
Feb. 25.	Brick sewer, Jersey City, N. J.		Feb. 14
Feb. 25.	Bridges, Des Moines, Ia.		Feb. 14
Feb. 26.	Jail, Beaumont, Tex.		Jan. 31
Feb. 26.	Plans for 2 school bldgs., Milwaukee		Feb. 7
Feb. 26.	Court-house, Sparta, Wis.		Feb. 7
Feb. 26.	Flooring, etc., Worcester, Mass.		Feb. 7
	Advertised, Eng. News, Feb. 7 and 14.		
Feb. 26.	Laying water mains (16 sts.), New York		Feb. 14
Feb. 26.	Paving, St. Louis Mo.		Feb. 14
Feb. 26.	Cement, New York, N. Y.		Feb. 14
Feb. 26.	Iron bridges, Auburn, Ind.		Feb. 14
Feb. 26.	Bridge, Toronto, Ont.		Feb. 14
Feb. 26.	Wharf at Burnt Church, N. B.		Feb. 14
Feb. 27.	Removing dredge, New York, N. Y.		Feb. 7
Feb. 27.	Sewers, Cleveland, O.		Feb. 7
Feb. 28.	Breakwater repairs, Duluth, Minn.		Jan. 24
Feb. 28.	Brick paving (5,700 sq. yds.), Easton, Pa.		Feb. 7
	Advertised, Eng. News, Feb. 7 to 21.		
Feb. 28.	Electric lighting, Urbana, O.		Feb. 7
Feb. 28.	Cedar blocks, Fort Wayne, Ind.		Feb. 7
Feb. 28.	Stone, cement, etc., Duluth, Minn.		Feb. 7
Feb. 28.	Water-wks. system, Port Clinton, O.		Feb. 7
	Advertised, Eng. News, Feb. 7.		
Feb. 28.	High school building, Portage, Wis.		Feb. 14
Feb. 28.	Water-works system, Canandaigua, N.Y.		Feb. 14
Mar. 1.	Electrical subways, Baltimore, Md.		Feb. 7
Mar. 1.	Removing shoals, Detroit, Mich.		Feb. 7
Mar. 2.	Pump and boilers, Willimantic, Conn.		Feb. 7
	Advertised, Eng. News, Jan. 31 to Feb. 21.		
Mar. 4.	Water-works system, Credo, W. Va.		Feb. 14
Mar. 4.	Artesian well bonds, Abbeville, Ga.		Feb. 14
Mar. 4.	Pile dike, Duluth, Minn.		Feb. 14
Mar. 4.	Court house work, Bakersfield, Cal.		Feb. 14
Mar. 6.	Water-wks. system, Ashland, O.		Feb. 7
	Advertised, Eng. News, Feb. 7 to 21.		
Mar. 6.	Pile bridges, Plattsmouth, Neb.		Feb. 7
Mar. 6.	Brick paving, Sandusky, O.		Feb. 14
Mar. 7.	Plans for school bldg., Milwaukee, Wis.		Feb. 7
Mar. 7.	Paving (10 streets), Cleveland, O.		Feb. 14
Mar. 8.	Highway bonds ($100,000), Athens, O.		Feb. 14
Mar. 11.	Water-wks. system, Knoxville, Ill.		Feb. 7
	Advertised, Eng. News, Feb. 7 to March 7.		
Mar. 11.	Dredg'g and remov'g ledge, Portland, Me.		Feb. 14
	Advertised, Eng. News, Feb. 14 to Mar. 7.		
Mar. 11.	Water bonds, Lafayette, Ind.		Feb. 14
Mar. 11.	Court house, St. Joseph, Mich.		Feb. 14
Mar. 27.	Plans for school bldg., Milwaukee, Wis.		Feb. 7
Mar. 12.	Drains, Mount Morris, Mich.		Feb. 14
Mar. 12.	Brick paving, Peoria, Ill.		Feb. 14
	Advertised, Eng. News, Feb. 14 to 28.		
Mar. 15.	Sewers (7 miles), Bristol, Conn.		Feb. 14
	Advertised, Eng. News, Feb. 14 to Feb. 28.		
Mar. 15.	Water-works system, Port Hope, Ont.		Feb. 14
Mar. 18.	Steel bridge, Atlanta, Ga.		Feb. 14
	Advertised, Eng. News, Feb. 14 to 28.		
Mar. 19.	Drains, Mount Morris, Mich.		Feb. 14
Mar. 19.	Electric lighting, Whitewater, Wis.		Feb. 14
Mar. 21.	Electric lighting, Meridian, Miss.		Feb. 14
	Advertised, Eng. News, Feb. 14 to Mar. 14.		
May 15.	Plans, etc., for bridge, Montreal		Jan. 24
	Advertised, Eng. News, Jan. 24 and 31.		
No date.	Artesian well, Montezuma, Ga.		Feb. 14
" "	Water-works system, Snow Hill, Md.		Feb. 14

RAILWAYS.

East of Chicago.

ADDISON & PENNSYLVANIA.—It is reported that this railway is to be extended from Galeton to Brookland, Pa., about 10 miles, and that it is expected to complete the extensions by July. Pres., T. C. Platt, New York.

CALDWELL.—A press report states that it is proposed to extend the Caldwell railway from Essex Falls to Whippany, and thence to Morristown, N. J. The route is southwesterly through the westerly portion of Roseland, across the Passaic River, south of the Swinefield Bridge, and through Hanover Neck to Whippany. From Whippany it will run either directly to Morristown or connect with the Rockaway road at Speedwell. The promoter of the proposed extension is the Rockaway Valley R. R. Co.

CENTRAL OF NEW JERSEY.—A press report from Hazleton, Pa., states that this railway is preparing to build into Hazleton. A contract between the Delaware, Susquehanna & Schuylkill is now a matter of negotiation between the officials of the two companies. The Central will build a belt line around Hazleton, though the line will probably be built by an independent company. A survey was made from Penn Haven to Hazleton, but was not very satisfactory to the engineers. It was also thought that this line could connect with the South Side branch, but it is claimed that the extension from White Haven will be the cheapest and easiest route.

COUDERSPORT & PORT ALLEGHENY.—The stockholders are reported to have authorized an extension from Sweden Valley to Ulysses, Pa., a distance of about 12 miles. Pres., J. L. Knox; Secy., A. B. Mann, Coudersport, Pa.

LAKE ERIE, ALLIANCE & SOUTHERN.—The report of the proposed extension of this road to the Ohio River is again revived. Ex-Lieut.-Gov. R. G. Richards, of Stubenville, a director, has just purchased for other parties 10,000 acres of valuable coal land lying adjacent to the route of the proposed extension between Bergholz and Dillonvale, at $32 an acre, according to reports.

MAINE.—The Lewiston "Sun" states that the survey for a railway from Milo Junction to Newport is being made this winter, and work on the road will probably be begun in the early spring. The new road

will connect with the Bangor & Aroostook at Milo Junction, where the main line of that road from Old Town to Brownville and the Katahdin Iron Works come together. The road will go to Newport, where two lines of the Maine Central meet, and will pass through Sebec, Atkinson, Charleston, Garland, Exeter, Corinth and Stetson, nearly all growing towns.

MEDIX RUN.—Incorporated in Pennsylvania to operate a steam railway from Medix Run station on the Allegheny Valley road, in Elk county, to Orchard station in Clearfield county, a distance of eight miles; capital stock, $80,000; Pres., Arthur M. Dodge, of New York; directors, J. W. Hartman and A. L. Amsden, of Medix Run, Pa., and Isaac S. Case and N. S. Brittain, of Tobyhanna Mills, Pa.

PHILADELPHIA & NEW ENGLAND.—This company has been organized in Milford, Pike county, Pa., by A. D. Brown, H. B. Wells, A. E. Lewis and J. H. Van Etten, of Milford; Horace L. Magee, Thomas A. Hay, James Searfass, and W. H. Tinsman, of Easton; A. H. Baker, of Three Bridges, N. J.; J. R. Bennett, of Hackensack, N. J.; Roy Stone, of Washington, D. C., and P. E. Farnum, of Port Jervis. Charles Stewart, of Easton, Pa., is president.

ULSTER & DELAWARE.—The directors of this company are reported to have decided to extend the line from its present terminus at Kingston, N. Y., to Kingston Point, in order to meet the traffic on the Hudson River Day Line steamers. The shoal water on the southerly side of the point will be crossed on a trestle 3,500 ft. long, and a terminal station will be built near the present winter berth of the "Mary Powell," on the end of the point. It is proposed to have the extension completed in time for next summer's traffic.

Southern.

ALEXANDER LUMBER.—Joseph Fuccy, who has the contract for extending the railway of the Alexander Lumber Co. from its present terminus near Huff, Randolph county, W. Va., to West Huttonsville, in the same county, has built shanties and has a big force of men ready to go to work along the entire five miles for which he has the contract, according to the "Railroad Gazette." J. E. Howell has taken a contract for nine miles more of the road, and will begin work before April. The road follows the Middle Fork River from Alexander to Cassity Creek, and up that stream to the limit of the Lumber company's lands. The road is to develop timber land belonging to the lumber company, and will, at the start, haul only its product, though it is the intention to enter into other business as soon as there is demand for it.

ARCADIA & HULL.—A press report from Arcadia, Fla., states as follows: It seems certain that the consolidated phosphate companies will build a railway from Arcadia to Hull, a distance of about eight miles. The contract for this part of the road is now let and work is expected to be commenced at once. They expect to continue it to Cleveland, where they can load the rock on large lighters and tow it to deep water for large vessels. They also expect in the near future to build a north end of this road from Scott's Siding, 23 miles above here, to Arcadia. It will be built along the river banks so they can take the rock from the dredge to the mill as well as haul it on to deeper water for shipment.

CHEAT RIVER.—Guffey & Queen, of Pittsburg, are having this railway surveyed from Point Marion, Pa., to Elkins, W. Va., a distance of about 100 miles, according to a press report, which states that W. K. Maple is employed in negotiating for the right of way. He has bought the Keyser & Frankerly mill property at Point Marion for $8,000. This is taken to mean the establishment of a furnace there. The Lake Erie road will connect at Point Marion with the Cheat River road, making a run of 200 miles from Pittsburg to Elkins, W. Va. This road will open up one of the best timber, coal and ore fields in the county. Guffey & Queen are acquiring a good many oil and gas leases and have begun drilling in the Dunkard oil field. The first well is down 1,500 ft. and will go 700 ft. deeper to the Gordon sand. They will drill the next well at Point Marion.

PALMETTO TERMINAL.—This company has been organized at Palmetto, Fla., to build a narrow gage railway to adjacent places. It is stated that sufficient money is in sight to build and equip two miles of the road, and that rails and locomotives have been ordered.

SELMER & TENNESSEE RIVER VALLEY.—The city of Selmer, Tenn., has voted to subscribe $10,000 to the capital stock of this company. The road is projected from Selmer, on the Mobile & Ohio, to the National Cemetery at Pittsburg Landing, on the Tennessee River.

Northwest.

MERRILL, ANTIGO & EASTERN.—A press report from Merrill, Wis., states that B. C. Cowen, Ch. Engr., was in that city last week and expected to commence the survey of this railway with 20 men this week.

Southwest.

ARKANSAS NORTHWESTERN.—A press report states as follows: The Arkansas Northwestern Ry. charter is being pushed through both branches of Congress with expedition. Senator Jones and Representative Dinsmore have charge of it, and have obtained favorable reports upon it. The road is to start from Southwest City, in McDonald county, Mo., and to run by the most practicable route through Indian Territory to a point between Chetopa and Baxter Springs, Kan.

CHICAGO, MILWAUKEE & ST. PAUL.—This company is reported as soon to build a new spur at Excelsior Springs, Mo., making its entrance by the way of the Dry Fork Valley, which would bring it in on the north side of the corporation. It is also claimed that this is the beginning of a line which the company intends to build in the near future from Excelsior Springs to St. Joseph, going by the way of Kearney.

GALVESTON & GREAT NORTHERN.—This projected railway was noted in our issues of Nov. 22 and 29 and the incorporation of the company was noted Dec. 20. A press report states as follows: The work of securing the right of way through the great wheat fields of central Kansas is now far advanced. Arrangements have been completed for the road entering Superior, Neb., and for all the land necessary for the terminal. Negotiations for the right of way through the larger towns in southern Kansas and Oklahoma are about completed. The $22,000,000 necessary to construct and furnish the road has been secured in England. At Galveston wharfage has been obtained for the line of steamers connected with the road, and the right of way has been secured through Texas and Indian Territory. The steel has also been purchased in England, and work will commence as soon as possible, probably this month.

NEW ORLEANS & WESTERN.—This company has petitioned for a franchise in the city of New Orleans. The road is projected from New Orleans to Dallas, Tex.; capital stock, $6,000,000; Pres., Armitage Matthews; Vice-Pres., Chas. B. Beasom.

OKLAHOMA CENTRAL.—The Senate Committee on Indian Affairs has reported favorably the House bill granting the company a right of way through the Indian Territory and Oklahoma, with some slight amendments, the most important of which is that the road shall begin at a point at or near Sapulpa, Ind. T., and go by way of Chandler and Oklahoma City to a point on the Red River at or near the west line of the Kiowa and Comanche reservation. This bill will probably become a law.

SAN ANTONIO & BROWNSVILLE.—Incorporated in Texas to construct a railway from San Antonio to Brownsville through the counties of Antascosa, McMullen, Live Oak, Duval, Nueces, Starr, Hidalgo and Cameron; capital stock, $300,000; main office to be at San Antonio; incorporators, J. S. Doak, J. M. Puett, J. A. Hinman, J. A. Ball, W. O. Hogan and J. M. Wallace, of San Antonio; J. W. Preston, of Pleasanton; J. S. Whissett, of Campbellton; Ed. Mullen, of Yoakum, and Lee Doak, of Fort Worth.

Rocky Mt. & Pacific.

CARTER & CHINAMAN LAKE.—A press report from Fort Bridger, Wyo., states that arrangements are almost completed for the building of the railway from Carter Station, on the Union Pacific, to Chinaman Lake, in the Uintah Mountains, a distance of about 75 miles. Capitalists of the East and local capitalists are pushing the project. This road will pass through the Fort Bridger reservation and will be the most direct route to the great Uintah reservation in Utah. The terminus for the present will only be 80 miles from this much sought for country. It is proposed to push the road on through this reservation as soon as money and labor can do so. The present object of the road is to open a line to the great lumber and tie camps, also to some of the richest gold, copper and silver mines in the West. The only thing that has kept these mines back is the great expense attached to delivering the ore to the railways, as heretofore it has cost from $85 to $110 per ton to deliver it, and it could then be hauled only in the winter. The need of this road has been much felt by southwestern Wyoming ever since it has been settled, and it will be the only railway penetrating the Uintah Mountains and Uintah reservation.

GILA VALLEY, GLOBE & NORTHERN.—A new bill has been passed by the Senate to meet the objections of the President to a previous bill granting this company a right of way through the San Carlos reservation in Arizona.

INDEPENDENCE & SALEM.—An effort is being made to secure $40,000 in subscriptions of stock at Salem, Ore., for a proposed railway from Independence to Salem, 10½ miles.

RIO GRANDE & PAGOSA SPRINGS.—Incorporated in Colorado to build a railway from Lumberton, N. Mex., on the Rio Grande, to Pagosa Springs, Colo., tapping a region rich in lumber, coal and other minerals, and opening up a fine agricultural and stock-raising country; capital stock, $100,000; incorporators, J. J. McGinnity, Chas. D. McPhee, Wm. T. Field, Wm. P. McPhee, of Denver, and Edgar M. Briggs, of Catskill, Niobrara county, N. Mex.

Foreign.

MEXICAN INTERNATIONAL.—Press reports from Durango, Mex., state that construction will begin March 1 for the extension of this railway to the Pacific Coast. The Pacific terminus of the road will be at the port of San Blas, giving a direct connection with the western coast, via Durango, for all the trade of San Antonio, Tex., St. Louis, and other United States cities, and which will place them in a position to compete by a direct route for Central and South American trade.

MONTEREY & MEXICAN GULF.—It is reported at Monterey, Mex., that the arrangements have been completed for the construction of a branch of the Monterey & Mexican Gulf line from San Juan to Rio Grande City, Tex., and from Linares to the proposed new port of Soto La Marina, along the Gulf coast, midway between Tampico and the mouth of the Rio Grande. The San Antonio & Aransas Pass will build an extension from Alice, Tex., to Rio Grande City, forming another short outlet between Northern Mexico and the United States.

AFRICA.—A press report from Berlin, Feb. 11, states as follows: The "National Zeitung" says that negotiations are on foot between the colonial department and a group of bankers, headed by the Deutsch Bank, for the construction of a narrow-gage railway from a port on the German East African Littoral to the Victoria Nyanza and Lake Tanganyika. The estimated cost of the line is 30,000,000 marks. Should the government approve the scheme, the Reichstag will be invited to grant land concessions to the company and to guarantee 3% interest on the capital.

STREET AND ELECTRIC RAILWAYS.

BURNHAM, ME.—The Waldo & Somerset Ry. Co. has petitioned for permission to extend its line from this place to Sandy Bay. V. R. Tuttle is interested.

ELLSWORTH, ME.—The construction of an electric railway from Ellsworth Falls to some point on the bay is being discussed. It is reported that the Rockland & Ellsworth Steamship Co. is willing to take two-thirds of the stock if the citizens will take the remainder.

PLAISTOW, N. H.—It is reported that a company has petitioned for a charter to incorporate an electric railway company to build a line from Haverhill to this place. W. H. Hillis, J. W. Sleeper and H. H. Cushing are interested.

BRATTLEBORO, VT.—It is stated that plans are about completed for constructing the proposed electric railway between this village and West Brattleboro and Hinsdale, N. H. The main line is estimated to cost $40,000, but the authorities of this village are reported as opposed to the project, and the promoters have petitioned the railroad commission for the right of way.

WINOOSKI, VT.—The Winooski & Fort Ethan Allen Electric Ry. Co. reports that the projected railway to Fort Ethan Allen will be built in the spring. It is stated that outside capitalists are trying to secure the franchise.

ABINGTON, MASS.—The Abington & Rockland St. Ry. Co. is reported about to issue $100,000 in bonds for improvements on its electric line. Supt., A. H. Walcott.

DIGHTON, MASS.—It is reported that specifications are being prepared for the construction of the Dighton, Somerset & Swansea Ry., work on which will commence as soon as possible.

NATICK, MASS.—The Natick & Cochituate St. Ry. Co. has petitioned for permission to extend its line to Wellesley.

NEWBURYPORT, MASS.—The Essex County St. Ry. Co. will have its electric railway between Newburyport and Ipswich in operation by July and from Ipswich to Wenham, a distance of nine miles, by the season of 1896, according to reports. Pres., Chas. H. Odell, of the Newburyport & Amesbury Ry. Co.; directors, Milton Ellsworth, of Rowley; S. M. Baken, of Ipswich; Geo. H. Plummer, of Newbury.

NORTHAMPTON, MASS.—It is reported that the Northampton St. Ry. Co. is considering the question of extending its electric line 1¼ miles. Gen. Man., A. E. Smith.

BRIDGEPORT, CONN.—Press reports state that Col. N. H. Heft, Pres. Bridgeport Traction Co., is to have complete supervision of the installation of electricity on the Nantasket Beach Division of the New York, New Haven & Hartford R. R., if the experiment proves successful. He is at the head of the company's electrical department. President Clark and Colonel Heft have decided on the location of the power station as one mile from the Old Colony House Station, on the Nantasket Division. Regular coaches will be used, hauled by baggage cars equipped with motors. If successful, electric locomotives will be substituted later. It is expected that Colonel Heft will resign the presidency of the traction company soon.

NEW LONDON, CONN.—W. A. Tucker, Boston, Treas. Norwich St. Ry. Co., is reported as stating that the company has secured a charter for its electric line to Norwich, and that work will begin in the spring.

APEX, N. Y.—The Delaware Valley Electric R. R. Co. is to be incorporated in the spring to build a line from this place to Cannonsville, according to reports.

CORNING, N. Y.—It is reported that work will begin on the construction of the Corning & Painted Post Electric Ry. about March 1 and the road completed by Dec. 1, at a cost of $125,000 to $150,000. The company, which was recently incorporated by New England capitalists, has a 50-year franchise.

HERKIMER, N. Y.—The Little Falls & Herkimer St. Ry. Co. has been incorporated to build an electric railway between Little Falls and this place, a distance of eight miles; capital stock, $10,000; directors, Clinton Beckwith, John D. Henderson and Geo. A. May, of Herkimer; John V. Quackenbush, of Mohawk; Nelson J. Davis, of Utica, and W. F. Lansing, Little Falls.

MASSENA, N. Y.—It is reported that surveys have been made between the Junction and Dodge's Landing for an electric railway. H. H. Warren is interested.

NEW BRIGHTON, N.Y.—The Staten Island Electric R. R. Co. has been granted permission to extend its line to South Beach and from West Brighton through the center of the island to the beach. Gen. S. Thomas, T. F. Ryan and H. H. Rogers are some of the directors. ——The Midland Co., Pres., Nathaniel Miles, operating horse railways in West Brighton and Stapleton, has been granted a franchise to equip its lines with electricity and extend them to the beach at New Dorp and to Richmond.——The Staten Island Interior Electric R. R. Co., in which Erastus Wiman is interested, has also been granted a franchise for a line 12 miles in length. A later item states that an injunction has been secured, it is supposed in the interest of the Staten Island Rapid Transit Co., restraining the supervisors from finally granting the rights of way to the above companies.

NEW ROCHELLE, N. Y.—The New York, Westchester & Connecticut Traction Co. has been incorporated to build an electric railway 16 miles in length; capital stock, $600,000; directors, Martin J. Keogh, of New Rochelle; Bernard Kates, of Paterson, N. J.; John Foley, Jr., of Sewaren, N. J.; and John F. Couch and John A. Bensel, of New York. This road is supposed to be an extension of the People's Traction Co.'s, of New York, recently incorporated.

NEW YORK, N. Y.—The Metropolitan St. Ry. Co. has petitioned for permission to extend its line from 116th St. and Manhattan Ave., to Amsterdam Ave., and from Kingsbridge road to 11th Ave., or the Boulevard. The company has also filed plans for a two-story power house at 147th St. and Lenox Ave., to cost about $250,000.

NIAGARA FALLS, N. Y.—Press reports state that the contract has been let for the construction of that part of the Niagara Falls & Buffalo Electric Ry., between this city and Tonawanda, which will connect Buffalo and the Falls. The right of way was secured some time ago.

NORTH TONAWANDA, N. Y.—Geo. P. Smith has petitioned for a franchise for an electric railway from Oliver St. to the village limits, and W. Caryl Ely, of Niagara Falls, for a franchise for an electric line on seven streets.

OGDENSBURG, N. Y.—The Ogdensburg St. Ry. Co. is reported about to increase its capital to $150,000 for equipping the line with electricity. Materials for the equipment will be shipped about March 1. The company is considering buying a water power plant from H. L. Jones, Cy. Clk., or H. Rodee. H. A. Sage, of Austin, Pa.; J. B. Bailey, of New Jersey, and R. E. Waterman, Ogdensburg, are interested.

SENECA FALLS, N. Y.—The trustees have granted a franchise for an electric railway to Bull's Grove and Orchard Beach, work on which is expected to be commenced as soon as possible. The road will probably cost about $100,000.

WHITE PLAINS, N. Y.—The New York, Elmsford & White Plains R. R. Co. has been granted a franchise for an electric railway, which is to be in operation by Aug. 1.

HADDONFIELD, N. J.—The West Jersey Traction Co. has been granted permission to extend its electric railway on Main St. to the bridge.

NEWARK, N. J.—The Franklin township committee has granted a franchise to the Passaic & Newark Electric R. R. Co.

PATERSON, N. J.—Press reports state that the James A. Morrisse system of electric railways operating between Singac, Paterson, Passaic, Rutherford, Hoboken, and Jersey City, has been absorbed by the New Jersey Electric Ry. Co. Six individual companies are consolidated, and the officers of the new company are: Pres., Chas. A. Johnson; Vice-Pres., Thos. D. Jordan; Treas., James A. Morrisse; Secy., John J. Scanlan. Among the principal stockholders are Henry P. Hyde, Gen. Louis Fitzgerald, and Col. F. K. Ham, of New York. The new company has filed a mortgage for $3,500,000 of 5% bonds in Passaic, Bergen and Hudson counties. A large power house with a 3,000-HP. engine is being built at Secaucus. Mr. Morrisse is reported as stating that through lines to Jersey City will be in operation about April 1. The line runs almost parallel to the Erie R. R. and is now complete and in operation from Singac, Passaic county, to Rutherford. The cars are of the vestibule pattern.

DARBY, PA.—The Chester & Delaware County Electric Ry. Co. has completed surveys for its line to Lancaster.

PITTSBURG, PA.—The Washington & Tylerdale St. Ry. Co. has been incorporated with a capital stock of $12,000; Pres., A. E. Townsend, of Pittsburg; directors, J. F. Black and S. Stewart, of Washington, Pa.; J. J. Miller, of Pittsburg.

PITTSTON, PA.—The Scoville Island St. Ry. Co. has been incorporated with a capital stock of $36,000 to build an electric railway between Wyoming, Exeter, West Pittston and Lackawanna; Pres., William L. Tompkins.

READING, PA.—The highway committee has voted to recommend the granting of a franchise to the Birdsboro St. Ry. Co.

SCOTTDALE, PA.—It is reported that the promoters of the electric railway from Broadford to Scottdale are extending their plans to include a branch to Mount Pleasant, and to continue the line through the Sewickley valley to Huff's station, where connection will be made with the Greensburg & Hempfield Ry.

SHARPSBURG, PA.—The Millvale, Etna & Sharpsburg Electric St. Ry. Co. has been granted a franchise, and it is stated that work on the road will commence as soon as possible.

STRASBURG, PA.—The construction of an electric railway to this city from Lancaster is being discussed.

BOONSBORO, MD.—Press reports state that the incorporators of the company to build an electric railway from Boonsboro to Keedysville, using the incompleted South Mountain Electric Ry. roadbed, noted last week, will be: Robert J. Shafer, Moses Bomberger, Alfred C. Huffer, Henry S. Beard, George W. Gilbert, David W. Barkman, Hiram B. Snively, Silas Ridenour, Dr. S. Selbert Davis and Harvey L. Storm, of Boonsboro, and Isaiah Moser, of Frederick county. The capital stock is $30,000.

ATLANTA, GA.—The Atlanta Electric Ry. Co. has been incorporated to build a road from the center of the city to Hopeville and Piedmont Park; capital stock, $100,000, with privilege of increasing it to $500,000; incorporators, Peyton Hale, Charles Runette, J. R. Collins, L. Z. Rosser and Thos. B. Felder.

BAY CITY, MICH.—Press reports state that at the next meeting of the council a petition will be presented from the Bay City & Saginaw St. Ry. Co. asking for the right of way from the Third St. bridge to Washington Ave., to Center Ave., to Water St., and to the Third St. bridge. The Consolidated St. Ry. Co. has already tracks on these streets. It is understood that the Saginaw company will make arrangements to use the Consolidated company's tracks. The Saginaw company says in its petition that it will enter West Bay City at the western terminus of Midland St.

CHICAGO, ILL.—The car barn of the Lincoln Ave. cable line was burned Feb. 13, destroying 111 cars and causing a loss of $300,000, according to a press report. ——The General Electric Railway Company has been incorporated with a capital stock of $5,000,000; incorporators, Daniel M. Simmons, Wm. A. Youmans and George Pfleger.——The Chicago City Ry. Co. will begin equipping its Wentworth St. and Ashland Ave. lines with electricity as soon as the weather permits, according to press reports. Supt., M. K. Bowen.

JOLIET, ILL.—The Joliet St. Ry. Co. proposes to extend its electric line and to make other improvements.

ST. LOUIS, MO.—The St. Louis Belt Ry. Co. has been incorporated to build an electric railway; capital stock, $2,000, with $2,000 paid in; incorporators, Chas. Green, L. M. Rumsey, R. C. Kerens, John Mullally and Moses Rumsey.

FLORENCE, COLO.—The Florence Belt Line Ry. Co. has been incorporated with a capital stock of $25,000, to build an electric railway; incorporators, E. M. Well, Leon Sefrs, C. E. Huff and James H. Crandall.

LOS ANGELES CAL.—The Los Angeles Traction Co. has been incorporated at Springfield, Ill., to build street railways in California; capital stock, $100,000; incorporators, Thos. J. Hook, Francis Hook and Marcus Hook.

HALIFAX, N. S.—The Halifax Electric Tramway Co., Limited, has been incorporated by H. M. Whitney, Halifax; G. B. M. Havey, Boston; M. Dwyer and W. B. Ross, of Nova Scotia, and James Ross, Montreal.

ELECTRIC LIGHT AND POWER.

NEWPORT, ME.—The Newport Electric Light & Power Co. has petitioned the legislature for a charter.

PROCTOR, VT.—It is reported that bids will soon be asked for putting in an electric light plant.

SUFFIELD, CONN.—Wm. L. Loomis, Town Clk., writes us that a charter has been applied for to include electric lights and water supply. If the charter is granted an engineer will be secured, but not earlier than April.

BROOKLYN, N. Y.—The board of public works has rejected all the bids for lighting the public buildings and streets by electricity and has directed the commissioner of city works to prepare specifications for new bids.

ALLEGHENY, PA.—The council has awarded a contract to the Western Electric Co. for Ball engines for the electric light plant, at $13,000, without foundations. The same company bid $14,500 for Ball engines, with foundations complete, and $14,185 for Westinghouse engines without foundations.

PHILADELPHIA, PA.—The council is again agitating the question of constructing its own electric light plant.

MARYSVILLE, PA.—A. G. King, Clk. Council, writes us that Seidel Bros. have been granted a franchise for an electric light plant.

WASHINGTON, D. C.—Bids are asked until Feb. 16 for excavating a shaft for the wheel pits of the company's power house at Great Falls. The shaft is to be six feet by eight feet in horizontal dimensions, and about 70 ft. deep. The formation is a gneiss rock, with nearly vertical stratification. Bidders will state their price per foot in depth of the shaft. The successful bidder will be required to commence work immediately. Needham & Cotton, Attorneys for the Great Falls Power Co., 15 Sun Bldg.

COLUMBIA, ALA.—The construction of a municipal electric light plant is being discussed, according to reports. Geo. L. Campbell is interested.

MERIDIAN, MISS.—Bids are asked until March 21 for lighting the streets with 75 arc lights until 1897 and 100 arc lights from 1897 to 1900, as stated in our advertising columns. I. A. Mooser, Cy. Clk.

VICKSBURG, MISS.—Press reports state that the electric light plant in this city, lately owned by the Hill City Electric Light Co. is to be thoroughly reconstructed by the new company at an estimated cost of $10,000.

LOWELLVILLE, O.—Wm. L. Erskine, Clk., writes us that the Mayor's proclamation for an election on Feb. 5 to vote on water-works and an electric light plant was recalled, and water-works at least have been given up for the present, but the electric light plant is still being discussed.

CLAY CITY, IND.—This place is to be lighted by electricity, according to reports.

JEFFERSONVILLE, IND.—The warden of the south prison has asked the ways and means committee of the legislature for an appropriation of $95,000 for an electric light plant and other improvements.

GALESBURG, MICH.—The question of electric lighting is being considered by the council.

GREENVILLE, ILL.—Press reports state that an electrician has made the council a proposition to take charge of the local water-works and also conduct and establish an electric light plant in this city for $3,000. It is the intention of the council to accept the proposition.

SALEM, ILL.—An electric light company is being formed in this city, according to reports.

MAUSTON, WIS.—The question of electric lights is being discussed, according to reports.

WHITEWATER, WIS.—Bids are asked until March 19 for 35 arc lights of 2,000 c.p. for a period of five years. A. W. Martin, Cy. Clk.

BISMARCK, N. DAK.—E. A. Hughes has been granted a 20-year franchise for an electric light plant, work on which will commence early in the spring.

KANSAS CITY, MO.—It is reported that Robt. J. Holmes, who has leased the exposition driving park, is negotiating for the purchase of an electric light plant for the track.

NEW COMPANIES.—Rawlins Electric Light & Fuel Co., Rawlins, Colo.; $50,000.

Hoosac Electric Power & Mfg. Co., Hoosac, Mass.; $100,000; N. S. Kelley.

San Antonio Electric Co., San Antonio, Tex.; $100,000; E. J. Obearne, Wm. H. McGow.

Llanerch Heat & Light Co., Llanerch, Pa.; $25,000, with $2,500 paid in; Treas., S. Henry Worth, Wawa.

Bloomington Gas, Electric & Steam Heating Co., Bloomington, Ill.; $50,000; Saml. P. White, J. P. Smith, John J. Patterson.

Electrical Mfg. Co., North Tonawanda, N. Y.; $25,000; to manufacture electrical supplies; Harold R. Wellman, Supt. of the Smith electric railways.

New York Lamp & Lighting Co., New York, N. Y.; $200,000; Duncan Cameron, Chas. C. Martin, Chas. F. Fogg, New York; L. K. McKinney, Brooklyn.

Iowa Falls Electric Light & Power Co., Iowa Falls, Ia.; $15,000; Pres., L. B. Bradley, Peoria, Ill.; Vice-Pres., J. B. McKay; Secy. and Treas., H. C. Miller.

Kraemer Electric Mfg. Co., Chicago, Ill.; $100,000; to manufacture motors, etc., for furnishing heat, power and light; Edward Koch, Frank Kraemer, Max C. Krueger.

American Falls Canal & Power Co., Ogden, Utah; $500,000; to utilize the American Falls in Idaho; Pres., Lyman Skeen; Secy. J. J. Brummitt; Gen. Man., Moroni Skeen; Ch. Engr., W. M. Bostaph.

Rahway Electric Light & Power Co., Rahway, N. J.; $200,000, with $1,000 paid in; Cassimer W. Boynton, Woodbridge, N. J.; Henry Maurer, Frank A. Pattison, New York; Jackson Jacques, Rahway; H. W. Douty, Asbury Park, N. J.; H. W. Thiele, Brooklyn, N. Y.

BRIDGES.

MANCHESTER, N. H.—A petition has been presented to the council asking for a bridge across the river at Hancock St.

PROVIDENCE, R. I.—The plans of the city engineer for the new Exchange St. bridge provide for an iron and steel bridge 132½ ft. long and 60 ft. wide, with four spans resting on abutments on the river bank and three stone piers, according to reports, and estimated to cost $75,000.

BUFFALO, N. Y.—The legislature has passed a bill appropriating $9,500 for a bridge over the Erie Canal at Mill St.

LONG ISLAND CITY, N. Y.—A committee of the supervisors from Kings and Queens counties met at Jamaica Feb. 12 and decided to build the proposed lift bridge over Newtown Creek, noted in our issue of last week, and instructed J. J. McLoughlin to prepare plans and specifications.

MAMARONECK, N.Y.—The Westchester county board of supervisors has appropriated $2,000 towards rebuilding a bridge between this city and Rye. The total cost will be about $18,000.

ROCHESTER, N. Y.—Plans have been prepared for a new lift bridge to replace the present lift bridges over the canal.

SENECA FALLS, N. Y.—It is reported that a proposition has been made to the trustees for a new bridge across the river at Rumsey St.

TROY, N. Y.—The city engineer has prepared plans for a bridge across the railway tracks at Rensselaer St.——The assembly has passed a bill appropriating $4,000 for a bridge at High St.

PITTSBURG, PA.—The Citizens' Bridge Co. was incorporated Feb. 11 to erect a bridge over the Allegheny River, from 5th St., in this city, to Darra St., in Allegheny; capital stock, $1,000, commencing with $100; Treas., S. A. Tomes.

WILMINGTON, DEL.—The city engineer is making borings for a proposed bridge on the lines of A and B Sts.

BALTIMORE, MD.—Burnheimer Bros. have petitioned for permission to build a bridge across Marion St. and a tunnel beneath the street to connect their present store with a new addition.

CHARLESTOWN, W. VA.—W. C. Frazier, J. W. Benner and E. C. Watson have been appointed by the county clerk to report upon the advisability of erecting a bridge at Baker's Mill, near the Berkeley county line.

ATLANTA, GA.—Bids are asked until March 18 for a steel highway bridge over the railway tracks on Broad St., as stated in our advertising columns. R. M. Clayton, Cy. Engr.; W. S. Bell, Chn. Com.

NATCHEZ, MISS.—The contract for an iron bridge over the Homochitto River, connecting Adams and Wilkinson counties, has been awarded to the King Bridge Co., of Cleveland, O., at $4,999. There were 19 bidders for the work.

CHATTANOOGA, TENN.—The city engineer has recommended that a new bridge be built in place of the present Eleventh St. bridge.

LINDEN, TENN.—Perry county has been authorized to issue $15,000 in bonds to build bridges across the Buffalo River.

ALLIANCE, O.—It is reported that the Pittsburg, Fort Wayne & Chicago Ry. Co. will erect a viaduct at this place.

IRONTON, O.—A $5,000 bridge is projected at this place, according to reports.

WARREN, O.—The Wrought Iron Bridge Co., of Canton, O., is reported to have been the lowest bidder Feb. 6 for a high-truss bridge 100 ft. long, with a 20-ft. roadway and 6-ft. walk, over Mosquito Creek at Niles.

AUBURN, IND.—Bids are asked until Feb. 26 for erecting three iron bridges, according to reports. Jas. Henderson, Pres. County Comrs.

BEDFORD, IND.—A press report states that this county will soon have five new iron bridges.

CHIPPEWA FALLS, WIS.—The Wisconsin Central Ry. Co. is reported as contemplating the erection of a steel bridge over the Chippewa River at Irvine in the spring.

MILWAUKEE, WIS.—A bill has been prepared for presentation to the legislature authorizing this county to issue $100,000 in bonds to construct a viaduct as a continuation of Grand Ave. to the county buildings at Wauwatosa.

DES MOINES, IA.—Bids are asked until Feb. 25 for building bridges in the third, fourth and fifth supervisors' districts of Polk county, during 1895. Supervisors: A. Nelson, third district; J. M. Chaffey, fourth district; J. P. Cook, fifth district.

DULUTH, MINN.—The board of public works has directed the city engineer to prepare plans for an iron bridge across the St. Louis River.——The house committee has reported favorably the bill authorizing the construction of a bridge across the St. Louis River between Wisconsin and Minnesota at a point to be determined by the Secretary of War.

FERGUS FALLS, MINN.—A bill has been introduced in the legislature appropriating $5,000 for bridges in this county.

ST. PAUL, MINN.—The city clerk has been instructed to advertise for bids for an iron bridge across Como Ave., span either 100 or 150 ft. in width.——The council is considering a proposition to widen one end of the Wabasha St. bridge at a cost of $173,000.

COTTONWOOD FALLS, KAN.—A bill has been introduced in the legislature authorizing the county commissioners to build certain bridges in this county.

ST. LOUIS, MO.—The council has passed ordinances authorizing the construction of two iron bridges across Main St.

PORT TOWNSEND, WASH.—The Oregon Improvement Co. is reported about to build four cantilever bridges across the river south of this place, at a cost of $250,000.

TORONTO, ONT.—Bids are asked until Feb. 26 for the construction of a steel or wooden bridge in the Island Park. John Hallam, Chn. Park Com.

BUILDINGS.

PROVIDENCE, R. I.—Bids are asked until Feb. 20 for constructing two four-room brick schoolhouses. D. F. Hayden, Clk. Com.

BUFFALO, N. Y.—Supt. Emerson, of the department of education, has recommended to the aldermen that new school buildings costing $200,000 be erected during the coming year. The matter was referred to the committee on schools. It is proposed to meet the cost by issuing special school bonds.

NEW YORK, N. Y.—Bids are asked by the board of school trustees of Ward 23, 146 Grand St., until Feb. 25 for altering, etc., the building on the southwest corner of 142d St. and Brook Ave.——Bids are asked until Feb. 25 by the commissioners of the sinking fund for erecting a public building on Crotona Park; Arch., Geo. B. Post, 33 East 17th St.——Frederick Gerken, 52 West 75th St., has filed plans for a 12-story brick office building to cost $140,000.——J. C. Lyon, 67 East 127th St., has filed plans for a 10-story brick office building to cost $180,000.——J. T. Williams, 871 Madison Ave., has filed plans for a 12-story brick office building to cost $350,000.

WHARF.—Ottawa, Ont.—Bids are asked until Feb. 26 for the construction of a wharf at Burnt Church.

PITTSBURG, PA.—Bids are asked until Feb. 18 for the erection of a building for the department of public safety; Arch., Chas. Bichel, 524 Penn Ave.; J. O. Brown, Dir. Dept. Pub. Safety.—The Pittsburg Armory & Auditorium Association has been formed and is reported about to erect a new armory to cost $150,000, on the Allegheny Wharf between the Sixth St. bridge and the exposition buildings, for the 14th and 18th regiments. Chn., W. H. Keech; Secy., W. J. Diehl.

WASHINGTON, D. C.—W. M. Poindexter is preparing plans for an office building on Ninth St. between D and E Sts.

STEUBENVILLE, O.—A correspondent writes us that plans are being prepared for an addition to the county court house in this city.

CONNERSVILLE, IND.—The Steel Storage & Elevator Construction Co. has been incorporated with a capital stock of $100,000; incorporators, Daniel T. Roots, Edgar T. Johnston and Frederic Webber.

MILWAUKEE, WIS.—It is stated that the Pabst Brewing Co. is preparing plans for rebuilding the Stadt theater at a cost of $150,000; the new building to be the finest theater in the city.—W. W. Wallis is reported about to construct a four-story office building to consist entirely of iron, plateglass and sheet metal, at a cost of $30,000. Arch., H. J. Rotier.

PORTAGE, WIS.—Bids are asked until Feb. 28 for the erection complete of a high school building. Arch., W. A. Holbrook, Milwaukee; William Fulton, Clk. Bd.

ST. JOSEPH, MICH.—Bids are asked until March 11 for the erection of a new fireproof court house in this city. Archs., Bell & Kent, Council Bluffs, Ia.; J. F. Gard, Secy. Com.

EAU CLAIRE, WIS.—A correspondent writes us that a bill has been introduced in the legislature providing for a new state prison to be built in this city. C. A. Alderman is city engineer.

CHICAGO, ILL.—Henry Ives Cobb has completed plans for the building for Lewis Institute, which will cost about $300,000.—Kenevel, Probst & Gassman have made plans for several large buildings on the west side.—Willoughby, Hill & Co. are reported about to erect a large steel building at the southeast corner of Madison and Clark Sts. for a clothing store.

ST. JOSEPH, MO.—The union station in this city was destroyed by fire Feb. 9 causing a loss of $400,000, according to press reports.

BAKERSFIELD, CAL.—Bids are asked until March 4 for altering and repairing the county court house. H. S. Packard, Clk. Bd.

WATER-WORKS.

MACHIAS, ME.—John K. Ames, of the Machias Water Co., writes us that the legislature has been petitioned for a charter, but that the charter has not yet been secured.

DOVER, N. H.—There is talk of constructing a 20-in. conduit from Willard's Pond to the city for fire purposes.

NASHUA, N. H.—It is reported probable that the county commissioners will build works for the county buildings at Grasmere, at a cost of $40,000.

BOSTON, MASS.—The legislative committee on water supply has advertised hearings as follows: Feb. 13, to the town of Wenham; Feb. 14, to the city of Worcester, and Feb. 15, to the town of Belchertown.

MILLBURY, MASS.—The Millbury Water Co. has awarded the contract for pipelaying to L. A. Taylor, Worcester and Boston. The receiving well is being sunk by James Lyons. J. Herbert Shedd, of Providence, is president of the company.

NORTH BROOKFIELD, MASS.—The commissioners are considering plans for supplying Brookfield from the works of this place.

WALPOLE, MASS.—It is stated that the commissioners will begin work on an experimental pumping station at Blackburne Pond as soon as the season opens, and it is expected that the center of the town will be supplied with water by Sept. 1.

WOONSOCKET, R. I.—The commissioners have cleared away trees, brush, etc., from over 150 acres of land for the proposed new reservoir, upon which it is expected the construction will be commenced this spring.

SUFFIELD, CONN.—W. L. Loomis, Town Clk., writes us that the Village Water Co. has petitioned for a charter to put in an electric light plant and water-works, but that no engineer will be engaged before April.

BINGHAMTON, N.Y.—The city is reported as considering the question of additional storage reservoir.

BLOOMVILLE, N. Y.—H. C. Soop, F. M. Andrus and others are reported as organizing a company to put in works at this place. This item was published last week by mistake under Bloomville, Del.

BROCTON, N. Y.—The residents of this village are reported as considering the advisability of putting in a gravity system of works.

BUFFALO, N. Y.—The board of public works recommends to the council that the present water-works tunnel be increased in size, that a new 30,000,000-gallon pumping engine be purchased and that engines Nos. 1, 2 and 3 be rebuilt and altered. The estimated cost of the improvements is $357,000. The board asks that it be authorized to prepare plans and specifications and advertise for bids so that the work can be done this year.

CANANDAIGUA, N. Y.—Bids are asked until Feb. 28 for constructing new works, according to reports. C. F. Robertson, Pres. Comrs.

CORNING, N. Y.—The mayor has recommended that $10,000 in bonds be issued to extend the mains in ward 5. It is reported that the city engineer is preparing plans for extensions to cost about $60,000.

GRAND GORGE, N. Y.—J. E. Hiel Vaughn, of Stamford, will soon make a survey of this village for a system of water-works, according to reports.

FORT PLAIN, N. Y.—The bids for works, as advertised in Engineering News, were not opened Feb. 5 owing to some legal technicality and it is stated that the contract will be awarded Feb. 28. The construction of new works is being opposed strongly by the present water company. Harvey Wick, Secy. Comrs.

KINDERHOOK, N. Y.—W. H. Rainey, Chn. Com., writes us that nothing definite has yet been decided upon; so far it is talk only.

LANCASTER, N. Y.—The plans for works, noted last week, were made by W. M. Small; estimated cost, $24,736. The Depew & Lancaster Water-Works Co. has offered to furnish a supply at 12 cts. per 1,000 gallons, with no charge for hydrants, and the question will be voted upon by the taxpayers March 2.

LESTERSHIRE, N. Y.—The trustees are reported to have offered $20,000 for the works which the owners have proposed to sell to the village for $25,000.

NEW YORK, N. Y.—Bids are asked by the department of public works until Feb. 26 for laying water mains in 16 streets.

ONEIDA, N. Y.—The trustees are considering the question of purchasing the works and it is reported probable that the matter will be voted upon at the next election.

PORT DICKINSON, N. Y.—The residents of this place are reported as investigating the question of works.

YONKERS, N. Y.—The council has approved the proposed issue of $300,000 in bonds for extensions, noted last week.

CLINTON, N. J.—It is reported that works will soon be put in.

HOBOKEN, N. J.—A bill has been introduced in the legislature authorizing this city to purchase land and construct works to cost $50,000. The Hackensack Water Co. now supplies the city.

JERSEY CITY, N. J.—Bids are asked until Feb. 18 for furnishing and laying 4,780 ft. of 12-in. and 500 ft. of 6-in. cast iron pipe. The work will include three 12-in. and twelve 6-in. gates and 250 cu. yds. of rock excavation. Geo. T. Bouton, Clk. Comrs.

NEWARK, N. J.—Bids are asked until Feb. 21 for a supply of 12 to 6-in. water pipe. J. C. Mundy, Supt. of Works.

ALLENTOWN, PA.—Plans are being prepared by Robt. S. Rathburn, Cy. Engr., for additional work at the pumping station, estimated as follows:

Removing 350 cu. yds. of old masonry at $2	$700
Removing 8,600 cu. yds. of earth at 32 cts.	2,752
Removing 2,150 cu. yds. of rock at 74 cts.	1,591
Placing 1,500 cu. yds. concrete at $6.37	10,555
Total	$15,598
Add for contingencies	1,500
Estimate cost to complete work	$17,098
Available appropriation	8,189
Balance to be provided for	$8,909

ALTOONA, PA.—The council is considering proposed extensions in a large number of streets.

ELIZABETH, PA.—The council of this place and West Elizabeth is reported as negotiating with Albert Smith, Engr., of Saltsburg, with regard to the construction of works. Mr. Smith is said to represent Pittsburg capitalists.

HAZLETON, PA.—This city is reported as suffering from a water famine. At the last election the citizens voted for municipal works, but no other steps have yet been taken in the matter. One of the water companies was also granted permission to lay larger mains, but this has not yet been done. It is stated that the project of new works is being pushed.

MARYSVILLE, PA.—A. G. King, Clk. Council, writes us that a franchise for water-works has been granted to H. M. Horner of this city and that the works will cost about $15,000.

MANOR, PA.—The question of works in this borough will be voted upon at an election Feb. 19; press reports state that a company offers to put in works and furnish 9 fire hydrants at $50 each per year.

MEADVILLE, PA.—Voorhees & Witmer, of Buffalo, have submitted a report estimating the value of the present works after 20 years' use and also the estimated cost of the system if built at the present time.

SHAMOKIN, PA.—The Roaring Creek Water Co. is reported about to construct a 350,000-000-gallon reservoir.

SOUTH BETHLEHEM, PA.—Thos. Ganey, Town Clk., writes us that the question of erecting works to be owned by the borough is being discussed, but has received no serious consideration as yet.

PHILADELPHIA, PA.—Frank H. Cheyney, of Wayne, Pa., is reported as at the head of a company organized to supply this city with water from the Susquehanna River at Columbia. Press reports state that the supply will be by gravity and will be brought through a steel-cased conduit 14½ ft. in diameter.

WEST NEWTON, PA.—The West Newton Water Co. has been incorporated with a capital stock of $500, to put in works; Treas., J. P. McIntyre, McKeesport.

MIDDLETOWN, DEL.—There is talk of borrowing $4,000 to improve the works, according to reports.

ANNAPOLIS, MD.—Bids are asked until Feb. 20 for the construction of an impounding dam and spillway for the Annapolis Water Co.

SNOW HILL, MD.—Bids are being received, according to reports, for constructing works, for which $18,000 in bonds have been sold. J. P. Moor, Mayor.

BRISTOL, VA.—This city is reported about to spend $8,000 in improving the works, including the building of a new reservoir.

CREDO, W. VA.—Bids are asked until March 4 for constructing works. C. F. Millinder, Secy. Com.

ABBEVILLE, GA.—Bids are asked until March 4 for $1,000 in 6% bonds for sinking an artesian well. Address Clerk Town Council.

ELBERTON, GA.—W. B. Henry, Clk. Council, writes us that the only steps taken for works is the act passed by the legislature authorizing the citizens to vote on an issue of bonds for the same.

MONTEZUMA, GA.—Bids are asked for sinking another artesian well. C. H. Richardson, Chn. W. W. Com.

QUINCY, FLA.—Wm. M. Corry, Gen. Man., writes us that the contract for constructing works has been awarded to Chas. A. Stookey, of Belleville, Ill., at $11,000, the bidders including: Herbert & Lapeyre, Chattanooga, Tenn.; Ripley-Detrick Supply Co., St Louis, Mo.; Elmore Iron Works, Birmingham, Ala.; R. D. Wood & Co., Philadelphia, Pa.; John T. Howard, Quincy, Fla.; W. J. Caldwell & Co., Louisville, Ky. Press reports state that Col. H. S. Duval, of Chattahoochee, Fla., has been engaged as engineer and superintendent and that the works will include a standpipe 105 ft. high.

CROWLEY, LA.—The council is reported to have received the following bids for the erection of water-works and electric light plant: J. Synon & Co. and C. B. Stewart, Opelousas, La., $19,200; Howard DeLong & Co., Lexington, Ky., $20,307; J. A. Holmoe, Louisville, Ky., for water-works only, $12,300; Southern Electrical Supply Co., New Orleans, $27,500. Numerous bids were received for parts of the work, but were not considered. No contract was awarded, but the council is considering the bid of Synon & Co. and Stewart, who will probably be awarded the contract.

NEW ORLEANS, LA.—The following bids were received Jan. 31 for about 22,000 ft. of extensions:

Bresnan & Co., Baltimore	$25,446
Robt. McNamara, New Orleans	18,273
Manion & Co., New Orleans	17,858
Foley & Co., New Orleans	17,700
Brenham, Gest & Co., Cincinnati	17,473
C. & F. Iglehart, Morgan Park, Ill.	16,990
Railway Supply Co., New Orleans	16,891
James O. Burns, New Orleans	16,725
Hankins, Mosby & Co., Richmond, Va.	16,591
Abbot-Gamble Contracting Co., St. Louis	14,988

The contract was awarded to the Abbot-Gamble Contracting Co., to whom a contract for 20,000 ft. of extensions was awarded Jan. 21.

BROWNSVILLE, TENN.—The citizens have voted to petition the legislature for authority to issue $12,000 in bonds to purchase the works.

KNOXVILLE, TENN.—A bill has been introduced in the legislature authorizing the city to issue $400,000 in bonds for municipal works.

ELIZABETHTOWN, KY.—The company proposing to put in works in this place has petitioned for an extension of time of three months.

LOUISVILLE, KY.—Chas. Hermany, Supt., writes us that no steps have yet been taken for a filter plant other than to investigate the subject and existing plants.

NICHOLASVILLE, KY.—The temporary contract with the water company has expired and the city is reported without a water supply.

CANAL DOVER, O.—J. A. Barry, Chn. Com., writes us that L. E. Chapin, of Canton, O., is preparing plans for works.

CANTON, O.—The council is considering the resolution providing for an election to vote on an issue of $20,000 in bonds for extensions.

CLEVELAND, O.—A correspondent writes us that the contract for 42 to 4-in. water gates has been awarded to the Rensselaer Valve Co., of Troy, N. Y. The other bidders were: Chapman Valve Mfg. Co., of Indian Orchard, Mass.; Murdock Valve Co., of Detroit, Mich.; Crane Co., Chicago; Ludlow Valve Mfg. Co., Troy, N. Y.; Michigan Brass & Iron Works, Detroit, Mich. The contract for cocks and valves was awarded to the Michigan Brass & Iron Works.

LORAIN, O.—F. C. Norcross, Supt., is reported as stating that the intake will be extended 1,000 ft. further in the lake.

LOWELLVILLE, O.—Wm. L. Erskine, Clk., writes us that the mayor's proclamation for an election to vote upon works and an electric light plant, Feb. 5, was recalled and that the water-works at least have been given up for the present, though the electric light plant is still talked of.

MARION, O.—The Marion Water Co. was incorporated in New Jersey Feb. 6, with a capital stock of $250,000, of which $1,000 is paid in; incorporators, Alfred G. Brown, Louis Hallock, Jr., Robt. H. Dillingham, Herbert F. Hatch, of East Orange, N. J., and Chas. N. Brown, of Jersey City. The plant of the Scioto Water Co. at this place was sold at auction Feb. 20.

TOLEDO, O.—The council has voted to submit the question of issuing $150,000 in bonds for extensions to the voters at the spring election April 1. The trustees have decided to purchase 1,000 tons of 12 to 4-in. pipe for the regular extension this year. L. P. Harris, Cy. Clk.

YOUNGSTOWN, O.—The trustees have nearly completed a large stand-pipe in the northern part of the city and have plans completed for another, according to reports.

INDIANAPOLIS, IND.—The council has ordered about 50,000 ft. of extensions. The contract with the water company calls for 20,000 ft. each year, but it is stated that the company will comply with the order to lay 50,000 ft. this year.

LAFAYETTE, IND.—Bids are asked until March 11 for the purchase of water bonds. T. W. Burt, Cy. Clk.

MUNCIE, IND.—F. G. Smith is reported as organizing a company which will petition for a franchise to put in works. It is stated that the supply will be from Buck Creek and will be filtered.

NEW ALBANY, IND.—A bill has been introduced in the legislature authorizing the purchase of the works.

CHICAGO, ILL.—The contract for a new pump at the Lincoln Park pumping station has been awarded to Fraser & Chalmers.

EDWARDSVILLE, ILL.—The council has extended the time for completing the works to May 1, and it is stated that works will be put in before that time. A franchise was granted some time ago but work was stopped after some $10,000 had been expended.

MARSEILLES, ILL.—The Crystal Mineral Water Co. has been incorporated to operate water-works at this place; capital stock, $20,000; incorporators, A. B. Adams, R. T. Knott, G. G. Stebbins.

YPSILANTI, MICH.—The special committee appointed by the mayor is reported as in favor of securing estimates at once for a 5,000,000-gallon pump.

CASSVILLE, WIS.—The citizens have voted to issue bonds for works.

EAU CLAIRE, WIS.—A correspondent writes us that the council is endeavoring to secure special legis-

lation whereby $258,000 can be raised for the purchase of the works. The city is now bonded to within $40,000 of the limit. C. A. Alderman is city engineer.

KAUKAUNA, WIS.—The council is reported to have accepted the proposition of W. H. Fritchman, 95 William St., New York, to put in works, as noted in our issue of Jan. 31.

MAUSTON, WIS.—Press reports state that every one seems to be in favor of putting in works and an electric light plant, and that there is talk of organizing a company to put in works.

OSHKOSH, WIS.—In the annual report of the board of public works it is claimed that the water supply is unfit for drinking purposes on account of sewage contamination.

WAUPUN, WIS.—The following bids were received for constructing the proposed municipal works, (1) being the lump sum for the complete plant according to the specifications, and (2) being the price per cubic yard for the rock excavation met with in the trenching:

	1.	2.
S. I. Pope Co., Chicago	$28,879	$2.60
Hinckley & Powers, West Superior	28,769	2.00
Foley & Connelly, Menominee, Mich.	31,004	4.50
Challenge Windmill Co., Batavia, Ill.	28,381	2.70
U. S. Wind Eng. & Pump Co., Batavia.	27,236	2.95
G. Cadogan Morgan, Chicago	27,695	2.00
Homer Crosby, La Crosse	27,689	3.90
Fairbanks, Morse & Co., Chicago	29,644	2.95
*W. H. Wheeler & Co., Beloit	26,950	1.00

*Awarded contract.

WHITE HALL, WIS.—An election will be held Feb. 23 to vote on an issue of $3,000 in bonds for works, according to reports.

FONDA, IA.—Bids are asked until March 1 for constructing works estimated to cost $7,000; a complete set of plans for $3. M. G. Coleman, Recdr.

IOWA CITY, IA.—The citizens continue to discuss the advisability of purchasing the works.

ANTHONY, KAN.—Press reports state that the standpipe of the Anthony Improvement Co. has been destroyed by the wind, causing a loss of about $5,000.

OTTAWA, KAN.—The works have been purchased by the Ottawa Fire & Light Co. Supt., J. W. Pollock.

MONROE CITY, MO.—Geo. W. Tompkins, Cy. Clk., writes us that no steps have yet been taken to secure works, and it is not probable that works will be put in at present; population, 2,500.

UNION, MO.—It is reported that the council is investigating the question of works. Edwin Baur, Cy. Clk.

SILOAM SPRINGS, ARK.—The Siloam Springs Improvement Co. has been incorporated to put in works, to construct a street railway and an electric light plant and to make other improvements; capital stock, $100,000; Pres., E. T. Wisner; directors, R. S. Morris, Z. T. Conley, R. G. Alfrey, F. M. Axtell and E. B. Watson.

DALLAS, TEX.—The council has adopted the report of the committee recommending the purchase of a 10,000,000-gallon pumping engine.

MOODY, TEX.—The Moody Artesian Well Co. has been incorporated by J. C. Reynolds, S. Hudley and others; capital stock, $25,000.

DENVER, COLO.—A resolution has been introduced in the board of aldermen providing for an issue of $2,750,000 in bonds to purchase the works.

LEADVILLE, COLO.—The Leadville Water Co. has been permanently restrained from allowing the water from the El Paso mine to flow into the reservoir.

ATHENA, ORE.—This city is reported to have accepted the proposition noted in our issue of Jan. 31 for works to cost about $12,000. Chas. Powers, of Seattle, is interested.

COTTAGE GROVE, ORE.—The Cottage Grove Water-Works Co. has been incorporated with a capital stock of $3,500; incorporators, H. Orchard, D. G. McFarland, J. P. Currin and J. W. Gowdy.

MITCHELL, ORE.—It is reported that surveys will be made for new works which will soon be constructed.

PORT HOPE, ONT.—Bids are asked until March 15 for constructing works. Engrs., McLennan, Stuart & Chapman, of Toronto; Town Clk., H. V. Sanders.

TORONTO, ONT.—Application will be made to the next legislature for authority to secure a water supply from any source within a distance of 60 miles from the city.

IRRIGATION.

COZAD, NEB.—A press report from this city states that it looks as if irrigation was to be an assured fact in this vicinity. Work is now being pushed on two ditches north of town, and hundreds of men and teams are thus finding steady employment. The Barnett-Record Co., having the contract for the ditch just north of town, as noted in our issue of Jan. 24, has an office in town and is pushing the work of excavation rapidly. A ditch 15 miles in length is now being surveyed on the south side of the river, and will be completed by May 1.

SEWERAGE.

ARLINGTON, MASS.—Geo. A. Kimball, Exchange Bldg., Boston, has been engaged to prepare plans for a system. The necessary surveys will be made by H. S. Adams, of Arlington.

FITCHBURG, MASS.—The committee has recommended that an appropriation be made for surveys for a complete system, as advised by the mayor.

HOLYOKE, MASS.—The committee is to ask for $7,000 for sewers.

LOWELL, MASS.—The council is to be petitioned for the immediate commencement of sewer construction to give work to the unemployed.

MEDFORD, MASS.—The committee on finance has been authorized to spend $15,000 for sewer pipe.

SALEM, MASS.—The committee is to submit a proposition to the council that authority be asked from the legislature to appoint a commission to consider the matter of a system for Salem and Peabody.—The committee has voted to ask for an appropriation of $50,000 for a sewer in Derby St.

SOMERVILLE, MASS.—The city engineer is preparing plans for draining 50 acres of land in West Somerville. The council has petitioned the legislature for permission to connect with the metropolitan system.

BRISTOL, CONN.—Bids are asked until March 15 for constructing a system about seven miles in length, as stated in our advertising columns. Miles Lewis Peck, Warden; Engr., T. H. McKenzie.

KINGSTON, N. Y.—The construction of sewers in portions of three wards is being discussed.

NEW YORK, N. Y.—Bids are asked by the department of public works until Feb. 26 for constructing a sewer in 123d St.

IRVINGTON, N. J.—W. C. Ward and N. B. Owen have been appointed a committee to secure surveys for a system. It is stated that the city of Newark will assist in the construction.

JERSEY CITY, N. J.—Bids are asked until Feb. 25 for constructing a sewer in Fulton Ave. The work will include 15,000 ft. of spruce sheathing, 1,450 ft. 30-in. brick sewer, 230 ft. of 12-in. pipe sewer and 250 cu. yds. of rock excavation. John E. McArthur, Chn. Com.

NEWARK, N. J.—The city surveyor is preparing plans for additional sewers.

RED BANK, N. J.—Hedenberg & Kinsley, of New York, have completed plans for a sewerage system at this place. The citizens have not yet voted on the question of construction.

MORRELLVILLE, PA.—An ordinance has been introduced into the council for the construction of pipe sewers in three streets. F. A. Cresswell, Borough Engr.

PITTSBURG, PA.—Ordinances have been passed for constructing 21 new sewers.

PITTSTON, PA.—The contract for constructing a system of sewers in West Pittston was awarded last week to Geo. Acock & Son, of Trenton, N. J., at $39,266. The bids were published in our issue of Jan. 3. The construction will probably be commenced in about a month.

WILLIAMSPORT, PA.—The committee has recommended the construction of a 10-in. sewer estimated to cost $4,500.

WASHINGTON, D. C.—John Jacoby, of Wilmington, Del., is reported as the lowest bidder, at about $35,000, for constructing certain sewers, the other bidders being Hussey & Brown, E. G. Gunnell, Thomas Buckley, B. J. Coyle, Lyons Bros., M. F. Talty, Sawders & Houston, Geo. S. Goode, H. Maylor, James McCandlish, Cudmore & Frawley, Bolden & Wormley, H. L. Cranford, John P. Larguey, Andrew Gleason and T. M. Leisher & Son.—The board of trade has adopted a report in favor of a proposed issue of bonds to continue the system of trunk sewers at a cost of $1,000,000 and to proceed with the work of completing a system of sewage disposal and protection against floods, in accordance with the plans recently recommended, at a cost not to exceed $3,350,000.

ATLANTA, GA.—The following bids have been received for constructing sewers: J. N. Hazlehurst & Co., Macon, Ga., $33,050; Collins Brick Co., $34,000; W. W. Griffin, $37,750; Chas. D'Alveyny, $38,975; General Contracting Co., $38,950; Chattahoochee Brick Co., $39,000; E. E. Copeland & Co., $39,775; Green & Co., $61,415. Sewer pipe: Montague & Co., Chattanooga, Tenn., $9,125; Lookout Sewer Pipe Co., Chattanooga, Tenn., $9,405; Henry Stevens & Sons, Macon, Ga., $10,520; Selpie Sons, Atlanta, $12,562; Evans & Howard, Louisville, $16,311. R. M. Clayton, Cy. Engr.

CLEVELAND, O.—Bids are asked until Feb. 13, 20 and 27 for constructing sewers. J. H. Farley, Dir. Pub. Wks.

TERRE HAUTE, IND.—The council is discussing a proposed belt sewer. It is stated that after the topographical map is finished an expert will probably be engaged to submit plans for a complete system.

MOUNT MORRIS, MICH.—Bids are asked until March 12 and 19 for constructing drains.

WATERTOWN, WIS.—The board of public works has decided to award the contract for constructing sewers to Wm. Gorder, of this city. The itemized bids were published in our issue of Jan. 23. G. O. Viebahn, Cy. Engr.

CEDAR RAPIDS, IA.—The board of public works has been directed to ask for bids for constructing several brick storm sewers.

MUSCATINE, IA.—Bids are asked until Feb. 20 for constructing two sections of a main trunk sewer. A. W. Gates, Cy. Engr.; D. T. Eaton, Cy. Recdr.

BERKELEY, CAL.—The West Berkeley progressive club is reported to have invited several contractors to submit estimates on a proposed storm sewer. It is stated that the lowest estimate was $88,000 less than the estimated cost of the work and that the trustees will be asked to authorize the improvement.

GARBAGE DISPOSAL.

ALLEGHENY, PA.—Steps are being taken to secure a site for a new garbage furnace.

ANDERSON, IND.—A correspondent writes us that this city contemplates the erection of a garbage crematory this year. Harry H. Rogers is city engineer.

INDIANAPOLIS, IND.—The board of health is reported as investigating the question of garbage disposal with a view to recommending the construction of a garbage crematory.

STREETS AND ROADS.

HOLYOKE, MASS.—The highway committee is to ask for an appropriation of $35,000, of which $15,000 will be for permanent work.

NORTHAMPTON, MASS.—The Highway committee has recommended an appropriation of $10,000 for road repairs and $8,000 for macadamizing.

BRIDGEPORT, CONN.—The council is considering the question of paving two streets with asphalt.

MOUNT VERNON, N. Y.—Bids are asked until Feb. 19 for the purchase of $100,000 of 4% highway improvement bonds. E. G. Pease, Cy. Clk.

SCARSDALE, N. Y.—The citizens are discussing a proposed issue of $20,000 in bonds for macadamizing the highways of the town.

POUGHKEEPSIE, N. Y.—The council is considering the paving of several streets in the spring.

WILLIAMSBRIDGE, N. Y.—It is reported that $25,000 of highway bonds have been sold.

ENGLEWOOD, N. J.—Colfax & Steele are reported to have been awarded a contract for macadamizing about 10 miles of highways in this township, at a cost of $25,000.

JERSEY CITY, N. J.—Plans have been prepared for paving two additional streets.

PATERSON, N. J.—Plans have been prepared for grading several streets. Thos. McLean, Cy. Surv.

ALLEGHENY, PA.—The board of public works has awarded the contract for improving Perrysville Ave. to C. I. McDonald, at $353,385. The prices of this contract are given under Contract Prices.—The contract for paving Linden Ave. with brick was awarded to H. C. Howard, at $15,314, and that for grading Riverview Ave. to Jas. McAfee, at $5,615.

LOCK HAVEN, PA.—B. P. Rittman is chairman of the committee appointed to investigate the cost of street paving. The council is reported as in favor of using brick.

PITTSBURG, PA.—Ordinances have been passed for paving and grading in several streets.

MACON, GA.—An election will be held March 16 to vote on an issue of $130,000 in bonds for public improvements, $28,500 of which is for paving. It is stated that the amount for paving will be increased to $125,000.

MOBILE, ALA.—The Mobile Paving Co., which was recently organized, is reported as making efforts to secure the paving of several streets with chert. P. J. Lyons and Adam Glass are interested.

NEW ORLEANS, LA.—The comptroller has been directed to advertise for bids for paving seven streets with Rosetta gravel, and Perdido St. with stone blocks, etc. D. A. Rose, Clk.

ATHENS, O.—Bids are asked until March 8 for the purchase of $100,000 in 30-year 5% road improvement bonds. A. J. Frame, County Audr.

CINCINNATI, O.—Bids are asked until Feb. 23 for paving Wilstach St. with brick. A. P. Butterfield, Clk. Bd.—Louis Reemelin, representing the Newcastle Asphalt Block Paving Co., has reported to the board of administration that his company wishes to compete for the improvement of streets and alleys by paving them with asphalt blocks.

CLEVELAND, O.—Bids are asked until Feb. 21 for grading seven streets, and until March 7 for five contracts each for paving with brick and dressed block Medina sandstone. J. H. Farley, Dir. Pub. Wks.

DAYTON, O.—Bids are asked until Feb. 25 for paving an alley with Medina, Hayden, Hallwood or asphalt blocks, sheet asphalt or brick. C. A. Herbig, Cy. Comptroller.

SANDUSKY, O.—Bids are asked until March 6 for paving Water St. with brick from Franklin St. to Lawrence St., according to reports A. W. Miller, Cy. Clk.

STEUBENVILLE, O.—Bids are asked by the commissioners of Jefferson county until Feb. 20 for constructing a road from Hammondville to Irondale, a distance of about one mile.

TOLEDO, O.—The aldermen are taking steps to pave Central Ave. from Collingwood Ave. to the Lake Shore railway tracks.

TERRE HAUTE, IND.—Bids are asked until Feb. 19 for paving Elm St. C. H. Goodwin, Cy. Clk.

AURORA, ILL.—Efforts are being made to secure additional paving in several streets.

GLENCOE, ILL.—The following bids were received Feb. 5 for improving 5,850 ft. of Sheridan road, including a bridge 89 ft. in length; Engr., W. S. Shields, Chicago:

Kissack & Muir, Chicago	$23,215
Doiese & Shepard, Chicago	21,840
Happ & Laing, Highland Park	21,500
Sackley & Peterson, Chicago	20,790
R. F. Wilson & Co., Chicago	21,250
J. B. Smith & Co., Chicago	19,764
James O'Laughlin, Chicago	19,340
C. & T. Iglehart, Morgan Park	18,591

PEORIA, ILL.—Bids are asked until March 12 for 29,479 sq. yds. of paving with brick, as stated in our advertising columns. Jacob A. Harman, Cy. Engr.; Isaac Taylor, Comr. Pub. Wks.

MARSHFIELD, WIS.—The council has voted to macadamize Central Ave., purchase a stone crusher and contract for about 200 cords of rock; work to begin at once, according to reports.

MUSCATINE, IA.—Bids are asked until Feb. 20 for 42,000 sq. yds. of brick paving. A. W. Gates, Cy. Engr.; D. T. Eaton, Cy. Recdr.

WATERLOO, IA.—Bids are asked until Feb. 25 for paving certain streets with brick. H. C. Schults, Cy. Clk.

ST. LOUIS, MO.—Bids are asked until Feb. 26 for repaving portions of 14 streets with brick and six streets with granite blocks. E. S. Foster, Secy. Bd Pub. Improvements.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

STREET SIGNS.—Newark, N. J.—The board of public works is considering the purchase of about 4,000 street signs.

DIKE.—Duluth, Minn.—Bids are asked until March 4 for building a pile dike in the harbor of Grand Marais, Mich. Maj. Clinton B. Sears, U. S. Engr. Office.

FREIGHT CARS.—St. Louis, Mo.—The Missouri, Kansas & Texas Ry. Co. is reported about to contract for 800 box cars, 500 coal cars, and 700 furniture cars.

TELEPHONE SYSTEM.—Atlanta, Ga.—A. J. West, J. R. Collins, T. B. Brady and others have petitioned for a franchise for a new telephone plant in this city.

DOCK.—Cleveland, O.—Bids are asked until Feb. 20 for reconstructing the dock at the foot of St. Clair St. on the Cuyahoga River. J. H. Farley, Dir. Pub. Wks.

CEMENT.—New York, N. Y.—Bids are asked by the department of public works until Feb. 26 for 1,200 bbls. of hydraulic cement and 140,000 gallons of No. 6 paving cement.

Northumberland county, N. B. E. F. E. Roy, Secy. Dep. Pub Wks.

BUOYS.—Detroit, Mich.—Bids are asked until Feb. 20 for placing and maintaining 66 spar buoys in Superior and St. Louis bays. W. W. Mead, U. S. Lighthouse Inspector.

NAVAL SUPPLIES.—Washington, D. C.—Bids are asked until Feb. 19 for sundry supplies for the navy yards at Norfolk, Va., and Brooklyn, N. Y. Edwin Stewart, Paymaster-General, U. S. N.

NATURAL GAS WELL.—Arcade, N. Y.—The Arcade Oil, Gas, Salt & Mining Co. is reported as negotiating with parties from Bradford and other places to put down a new well 3,200 ft. in depth.

TELEGRAPH WIRE.—Brooklyn, N. Y.—Bids are asked until Feb. 19 for furnishing 100 miles of No. 12 B. W. G. weather-proof, insulated, hard-drawn, copper telegraph wire. F. W. Werster, Comr. Fire Dept.

DREDGE.—Cincinnati, O.—The New Orleans & Northeastern R. R. Co. wishes to dispose of a dredge, as described in our advertising columns. George B. Nicholson, Ch. Engr.; George W. Stevens, Purchasing Agt.

DREDGING AND REMOVING LEDGE.—Portland, Me.—Bids are asked until March 11 for dredging and removing ledge in Kennebec River, as stated in our advertising columns. Maj. D. P. Heap, U. S. Engr. Office.

TELEPHONE CONDUITS.—New Haven, Conn.—The Southern New England Telephone Co. is preparing plans for underground conduits between Norwalk and South Norwalk, 1¼ miles, according to reports, the work to cost about $10,000.

PILING, ETC.—St. Louis, Mo.—Bids are asked until Feb. 21 for piling, lumber, wire-strand, second-hand cable, etc., for dike work at Omaha, Neb.; also at Leavenworth, Kan.; also for building a frame lock house at Brennekes Shoal, Mo. First Lieut. J. C. Sanford, Engr. Missouri River Comn.

CANAL.—Oconomowoc, Wis.—The company noted last week as being organized to build a canal to connect Oconomowoc, the Nashotah and Upper Nemahbin lakes has been incorporated as the Oconomowoc Lake Navigation & Improvement Co., and it is stated that the canal will be constructed next summer.

QUARRY IMPROVEMENTS.—Maybee, Mich.—The Michigan Stone & Supply Co., of Detroit, which owns stone quarries near this place, is reported to have appropriated $50,000 for improvements to be made this winter. The work will include a seven-gang stone sawmill, a large stone planer, three steam stone chandlers and another derrick.

DUMP SCOW.—Cincinnati, O.—The following bids were received by Lieut.-Col. Amos Stickney, U. S. Engineer Office, Feb. 1, for building one dump scow:

M. A. Sweeney Co., Jeffersonville, Ind.	$4,800
Edward J. Howard, Jeffersonville, Ind.	2,750
Cincinnati Marine Railway Co., Cincinnati.	3,484

BONDS.—Toledo, O.—Resolutions were passed by the common council Feb. 4 submitting the issue of $60,000 of bonds for fire-tug purposes and $150,000 of bonds for the extension of water mains to the people at the spring election April 1. Ordinances were also passed for the issue of $110,000 of general fund refunding bonds and also for the issue of $250,000 of bridge refunding bonds. The above measures were passed by the board of aldermen Feb. 4 and went to the board of council for concurrence on Feb. 11.

DREDGING MACHINERY.—Portland, Ore.—The following bids were received by Capt. Thos. W. Symons, U. S. Engineer Office, for dredging machinery at Coos Bay: Marion Steam Shovel Co., Marion, O., f. o. b. Marion, $9,000; f. o. b. San Francisco, $11,000; Bucyrus Steam Shovel & Dredge Co., South Milwaukee, Wis., f. o. b. South Milwaukee, $6,800, $7,800, $8,400; f. o. b. San Francisco, $8,800, $9,900, $10,550. Vulcan Iron Works, Chicago, f. o. b. Chicago, $5,400, $6,200, $6,500. Osgood Dredge Co., Albany, N. Y., f. o. b. Albany, $8,400, $9,350; f. o. b. San Francisco, $9,950, $10,970.

DEEP WATER.—Corpus Christi, Tex.—Press reports from this city state as follows: Indications point strongly to the fact that within the next 12 months Texas will have another deep-water harbor at Aransas Pass, 18 miles from Corpus Christi. Alexander Brown & Sons, of Baltimore, Md., have agreed to secure 20 ft. of water over the bar at the pass, provided they are given a land bonus amounting to $900,000. The counties of Aransas, Bee, San Patricio, Duval and Nueces are expected to raise the bonus. Soliciting committees have been at work in all of these counties for several weeks, and now report the required bonus almost raised, Nueces county alone having subscribed over $200,000 of the necessary amount. Active work on Willett's pier will also soon begin. This proposed pier is located at a point on Padre Island, 50 miles south of Corpus Christi. The promoters of the enterprise propose to build an iron viaduct out into the Gulf until a depth of 30 ft. of water is reached. Then they will build a stone breakwater and thus secure an artificial harbor. The iron for the viaduct is now on its way, and will probably reach its destination within a few days.

CONTRACT PRICES.

STEEL PIPE.—Cleveland, O.—We are informed that the following bids were received Feb. 1 for furnishing the materials and building and placing in position in a tunnel to be built under Cuyahoga River at Clark Ave. about 563 ft. of 48-in. wrought steel water pipe with cast iron chairs and steel suspension beams; pipe to be ⅝ in. thick and to include eight 45° bends:

William B. Pollock & Co., Youngstown, O.	$11,800
Danniel Connelly, Cleveland.	14,739
Carroll Porter Boiler & Tank Co., Pittsburg, Pa.	14,992
Riter & Conley, Pittsburg, Pa.	16,945
Variety Iron Works, Cleveland.	17,950
Variety Iron Works (with cast steel flanges).	17,000

ASPHALT AND STONE PAVING.—Allegheny, Pa.—The contract for improving Perrysville Ave. has been awarded to C. I. McDonald, at $353,385, for paving with Ligonier blocks and sheet asphalt with a choice of flagstone or granolithic sidewalks. The bid is reported as follows:

Excavation,	85,000	cu. yds., at	$0.38
Curbing,	36,000	lin. ft., "	.48
Crossing,	8,000	sq. ft., "	.90
Sidewalks, as above,	18,000	" "	.185
Ligonier blocks,	38,000	sq. yds., "	2.50
Granite, "	38,000	" "	3.20
Macadam,	45,000	" "	1.23
Asphalt,	45,000	" "	2.83
Masonry,	5,000	cu. yds., "	7.50
Inlets reset,	10,	each	3.50

A contract for 700 sq. yds. of asphalt paving in Bank St. has been awarded to the Sicilian Asphalt Paving Co. at $2.75 per sq. yd.; excavation, 40 cts.; curbing, 50 cts.——A contract for paving Union Ave. has been awarded to Sloan, McIlvain & Ott Bros. at the following prices:

Excavation	2,100 cu.yds., at	$0.57
Asphalt paving	3,100 sq.yds., "	2.79
Ligonier block paving	3,100 " " "	2.35
New curbing,	1,200 lin. ft., "	.50
Curb. reset and redressed.	80 " " "	.20
Granite crossing	500 " " "	.80
Crossing reset and redressed	100 " " "	.20

STREET IMPROVEMENTS.—Avondale, O.—The following bids were received Feb. 7 for the improvement of Rockdale Ave.; S. J. Osborn submitting a bid of $5,525 on combined concrete curb and gutter alone:

Bids for Improving Rockdale Ave., Avondale, O.

		A. Cotter.	J. Delayney.	P. Malloy.	Van Sandt & Meed.	Wilson & Strack.	Burns, Drack & Co.	J. J. Smith.
Grading,	1,000 cu. yds.	$0.35	$0.30	$0.28	$0.16	$0.30	$0.24	$0.19
Broken stone,	1,500 " "	1.70	1.60	1.76	1.67	1.25	1.75	1.93
5 × 21-in. curb,	6,450 ft.	.60	.60	.55	.54	.54	.65	.53
5 × 21-in. concrete curb,	100 "	1.00	.70	1.10	1.20	.80	1.20	1.00
6 × 18-in. crossings,	400 "	.50	.50	.50	.45	.54	.60	.48
6 × 16-in. flagging,	6,500 "	.55	.60	.50	.50	.45	.60	.53
12-in. pipe,	100 "	.60	1.25	.65	.60	.75	.60	.60
Catchbasins	2.	65.00	60.00	50.00	40.00	35.00	30.00	75.00
Remodelling inlets,	4.	17.00	10.00	25.00	18.00	5.00	10.00	12.00
22-in. drain pipe,	6,000 ft.	.04	.04	.04	.02	.02	.04	.04
Limestone paving,	200 sq. yds.	.90	.90	.75	.60	.50	.90	.75
Resetting curb,	100 ft.	.20	.25	.10	.15	.05	.20	.20
Rolling,	20,000 sq.yds.	.03	.04	.035	.035	.03	.035	.035
Gravel,	300 cu. yds.	1.50	1.75	1.50	1.25	1.40	1.40	1.44
C'nc'te curb & gut'r	6,500 " "	1.05	1.00	1.10	1.03	.90	.90	1.00
Total		$12,221	$12,633	$11,807	$11,132	$10,230	12,875	$11,355

SEWERS.—Bound Brook, N. J.—The council has awarded a contract for about 1,000 ft. of 8-in. vitrified pipe sewer, including Y branches every 12½ ft., to Maguire, McKnight & Co., Buffalo, at 47 cts. per lin. ft.; manholes, finished complete, $29 each; lampholes, $7; flush tanks, with Van Vranken system, $75; average cut, 9 ft. The work on the entire system of 25,000 ft., which was commenced Oct. 2, is about completed. The itemized bids for this work were published in our issue of Sept. 20. H. M. Herbert, Borough Engr.

ARTESIAN WELL.—Knoxville, Ill.—The following bids, per foot, were received Feb. 7 for drilling and casing an artesian well 1,500 ft. deep, as advertised in Engineering News; Consult. Engr., Chas. F. Sturtevant St., St. Louis, Mo.:

	8-in.	6-in.
J. Stevens & Co., Elgin, Ill.	$3.00	$2.75
S. Swanson, Minneapolis, Minn.	2.40	2.40
Whitney Water Supply Co., St. Louis, Mo.	3.35	2.85
Gray Water Supply Co., Milwaukee Wis.	3.50	2.00
W. H. Gray & Bro., Chicago, Ill.	3.60	2.55
J. P. Miller & Co., Chicago, Ill.	3.50	2.40

ROCK EXCAVATION.—Waupun, Wis.—The bids per cubic yard for the rock excavation encountered in the construction of the proposed water-works system are given, with the lump-sum bids for the complete plant under Water-Works.

FIRE HYDRANTS.—Cleveland, O.—The following bids were received Feb. 1 for furnishing and delivering about 250 4-in. and 12 6-in. fire hydrants, each hydrant to be 6 ft. in length from the pavement line to the top of pipe and must have a frost case and two discharge nozzles with independent gate for each nozzle; the main valve of the hydrant to open against the pressure by turning to the left; hydrants and principal parts thereof must be interchangeable with the present style of hydrant:

South Park Foundry & Machine Co., St. Paul.	$6,351.00
Northwestern Wheel & Foundry, St. Paul.	6,192.50
R. D. Wood & Co., Philadelphia, Pa.	5,920.00
Crane Co., Chicago, Ill.	5,737.80

LEVEE WORK.—New Orleans, La.—The following lowest bids were received by Capt. Derby Feb. 4: Hermitage dike enlargement, 9,000 cu. yds., J. J. Gray, 22.4 cts. per cu. yd.; Wildwood enlargement, 37,500 cu. yds., Ettringham Construction Co., 20.98 cts.; Robertson, new and enlargement, 12,200 cu. yds., M. Tansey, 9.80 cts.; Fort St. Philip, enlargement, 5,000 cu. yds., R. McNamara, 18 cts.

Greenville, Miss.—The Mississippi levee board has awarded to the lowest bidders contracts for building 100,000 cu. yds. of levee in Issequena county. L. C. Dulaney secured the contract for the upper half of Shipland levee, at 11.74 cts. per cu. yd., and E. Hyner the lower half, at 16 cts. per cu. yd. The bids ranged from 11.74 cts. to 23 cts.

SEWERS.—San Antonio, Tex.—The total bids received Dec. 20 for constructing 74 miles of sewers in this city were published in our issue of Jan. 10. The contract for the work was awarded to J. B. Hindry of Denver, Colo., at $331,209, although Stratford & Hawkes of Brooklyn, N. Y., bid $286,931, and George Baer of Kansas City, Mo., $322,833; S. M. Gray Consult. Engr., recommending against awarding the contract at a price much below the engineer's estimate, $342,886. A. C. Pancoast, Cy. Engr., has sent us an itemized summary of all the bids, from which we give below (1) the bid of Stratford & Hawkes, (2) the bid of J. B. Hindry, and (3) the average of the 22 bids, which aggregates $374,711; omitting only the bids for 11 crossings, in as many streets, and for special manholes, of which there is one in each of four streets:

		1.	2.	3.
Pipe Sewers.				
8-in.:				
0 to 6 ft. deep.	70,515 ft.	$0.28	$0.27	$0.339
6 " 8 " "	134,040 "	.30	.30	.377
8 " 10 " "	37,760 "	.35	.35	.438
10 " 12 " "	17,070 "	.42	.42	.527
12 " 14 " "	5,575 "	.48	.49	.615
14 " 16 " "	1,300 "	.50	.57	.712
16 " 18 " "	380 "	.56	.65	.833
10-in.:				
0 to 6 ft. deep.	2,070 "	.37	.36	.441
6 " 8 " "	8,740 "	.39	.43	.486
8 " 10 " "	2,010 "	.43	.48	.546
10 " 12 " "	5,320 "	.51	.54	.633
12 " 14 " "	1,060 "	.55	.61	.725
12-in.:				
0 to 6 ft. deep.	1,490 "	.44	.44	.515
6 " 8 " "	3,650 "	.46	.50	.563
8 " 10 " "	1,615 "	.50	.56	.638
10 " 12 " "	665 "	.55	.64	.724
12 " 14 " "	1,125 "	.61	.72	.819
14 " 16 " "	230 "	.66	.82	.925
15-in.:				
0 to 6 ft. deep.	935 "	.55	.58	.700
6 " 8 " "	6,130 "	.58	.65	.741
8 " 10 " "	4,290 "	.60	.72	.817
10 " 12 " "	2,860 "	.72	.80	.954
12 " 14 " "	4,335 "	.76	.90	1.007
14 " 16 " "	130 "	.79	1.01	1.135
18-in.:				
0 to 6 ft. deep.	175 "	.77	.78	.950
8 " 10 " "	3,750 "	.82	.93	1.051
10 " 12 " "	5,440 "	.80	1.03	1.150
12 " 14 " "	4,445 "	.93	1.13	1.260
14 " 16 " "	2,225 "	1.03	1.25	1.388
20-in.:				
0 to 6 ft. deep.	1,630 "	.88	.98	1.130
10 " 12 " "	2,930 "	1.00	1.24	1.416
12 " 14 " "	4,435 "	1.04	1.35	1.532
14 " 16 " "	1,425 "	1.15	1.48	1.672
24-in.:				
0 to 6 ft. deep.	1,400 "	1.18	1.37	1.501
6 " 8 " "	1,920 "	1.20	1.48	1.583
8 " 10 " "	1,555 "	1.26	1.57	1.692
10 " 12 " "	1,320 "	1.34	1.69	1.823
12 " 14 " "	1,500 "	1.40	1.80	1.962
14 " 16 " "	7,435 "	1.50	1.94	2.103
16 " 18 " "	525 "	1.60	2.10	2.270
18 " 20 " "	695 "	1.71	2.32	2.408
20 " 22 " "	595 "	1.83	2.53	2.644
Brick Sewers.				
26-in.:				
8 to 10 ft. deep.	1,300 ft.	$1.03	$1.34	$1.697
10 " 12 " "	825 "	1.11	1.43	1.844
12 " 14 " "	1,885 "	1.19	1.53	1.970
14 " 16 " "	1,480 "	1.27	1.65	2.155
30-in.:				
8 to 10 ft. deep.	760 "	2.30	2.93	2.992
10 " 12 " "	3,355 "	2.37	3.00	3.103
12 " 14 " "	680 "	2.53	3.14	3.274
14 " 16 " "	175 "	2.65	3.29	3.439
16 " 18 " "	2,125 "	2.77	3.48	3.656
32-in.:				
0 to 6 ft. deep.	200 "	2.33	2.95	2.823
6 " 8 " "	300 "	2.35	2.99	2.923
8 " 10 " "	200 "	2.44	3.08	3.072
10 " 12 " "	245 "	2.48	3.21	3.232
12 " 14 " "	600 "	2.61	3.35	3.411
36-in.:				
8 to 10 ft. deep.	720 "	2.62	3.43	3.415
10 " 12 " "	700 "	2.77	3.57	3.533
12 " 14 " "	1,210 "	2.90	3.72	3.723
38-in.:				
8 to 10 ft. deep.	205 "	2.78	3.61	3.531
10 " 12 " "	1,900 "	2.88	3.75	3.708
12 " 14 " "	580 "	2.96	3.91	3.893
14 " 16 " "	1,155 "	3.15	4.10	4.115
18 " 20 " "	4,560 "	3.51	4.62	4.525
40-in.:				
10 to 12 ft. deep.	1,865 "	3.00	3.91	3.895
12 " 14 " "	475 "	3.19	4.07	4.053
14 " 16 " "	400 "	3.29	4.26	4.304
16 " 18 " "	100 "	3.49	4.48	4.535
18 " 20 " "	230 "	3.70	4.75	4.767
48-in.:				
16 to 18 ft. deep.	200 "	4.19	5.32	5.137
52-in.:				
16 to 18 ft. deep.	500 "	4.61	5.72	5.555
Appurtenances.				
6-in. Y and T junctions on:				
24-in. pipe,	670, each	2.20	1.00	2.560
20-in. "	393 "	1.46	.70	1.789
18-in. "	641 "	1.26	.50	1.368
15-in. "	756 "	.84	.30	1.002
12-in. "	351 "	.64	.20	.684
10-in. "	793 "	.50	.15	.535
8-in. "	9,673 "	.36	...	.306
Double 6-in. Y's	1,019 "	1.20	...	.607
6-in. slants,	721 "	.20	.30	.337
6-in. vert. con.	7,856 lin.ft.	.08	.20	.162
Manholes:				
3 × 4 ft., up to 8 ft.	597, each	25.00	25.00	32.100
Per additional ft.	239 vert.ft.	2.75	2.00	3.099
4 × 5 ft., up to 8 ft.	242 each.	27.00	35.00	38.870
Per additional ft.,	97 vert.ft.	3.00	3.00	3.633
Flush tanks,	210, each	27.50	45.00	43.390
4-in. galvnzd pipe.	21,000 lin.ft.	.07	.15	.126
Lumber foundation,	10 M. ft.	15.00	14.00	19.740
Sheeting,	50 " "	9.00	14.00	16.920
Concrete.	100 cu. yds.	4.75	7.00	6.105
Hard rock.	100 " "	1.75	3.00	3.318
Loose rock.	130 " "	.40	2.00	1.595
Extra earth wrk.	1,000 " "	.25	.60	.613
Extra brick work.	100 " "	6.75	11.00	9.971
Repaving.	2,612 sq.yds.	1.40	1.30	1.444

BRICK PAVING.—Rock Island, Ill.—W. A. Darling, Cy. Engr., received the following bids Feb. 4 for paving 12th St., (1) being the bid of Edwards & Walsh Construction Co., (2) Rockford Construction Co., (3) Flick & Johnston, (4) H. L. Wheelan:

	1.	2.	3.	4.
National clay brick, sq. yd.	$1.05	$1.06	$1.20	.....
Galesburg brick, per sq. yd.	1.10	1.14	1.30	$1.20
Berea curb, per lin. ft.	.46	.45	.51	.41
Curb reset, " " "	.06	.05	.06	.01
Drain tile, " " "	.06	.04	.05	.02
Excavation, per cu. yd.	.13	.18	.21	.07
Brick culvert,	350.00	200.00	700.00	300.00
Tile culvert	85.00	80.00	140.00	100.00
Catchbasins, each	27.00	25.00	47.00	25.00
Inlets, each	6.00	10.00	30.00	25.00
Outlet tile, per lin. ft.	.35	.50	.19	.15
Total (Galesburg brick)*	$20,286	$30,358	$35,344	$29,618

* Awarded contract.

The contracts for paving Seventh Ave. and 30th St. were awarded to W. L. Wheelan, at $1.10 per sq. yd. for Galesburg brick, the other prices being the same as in his bill for 12th St.; total, $9,665 and $4,891. The bidders for Seventh Ave. and 30th St. were the same as for 12th St. with the addition of Atkinson & Oloff.

Toledo, O.—The contract for paving about 850 ft. of Wisconsin St. with one course of vitrified brick has been awarded to Wm. J. McMahon, of Toledo, at 83 cts. per sq. yd. for paving and 9 cts. for grading.

METAL MARKET PRICES.

LEAD.—New York: 3.12 to 3.15 cts. Chicago: 3 to 3.05 cts. St. Louis: 2.95 cts.

NAILS.—Pittsburg: 90 cts. for wire, and 80 cts. for cut at mill in carload lots.

BARBED WIRE.—Pittsburg: galvanized, $1.85; plain, $1.20 to $1.25 for carloads at mill.

FOUNDRY AND PIG IRON.—New York: $10.50 to $12.50. Pittsburg: $9.75 to $10.05. Chicago: $9.50 to $10.50.

TRACK MATERIAL.—New York: angle bars, 1.1 to 1.5 cts.; Spikes, 1.45 to 1.6 cts.; track bolts, 1.75 to 1. 85 cts. with square, and 1.9 to 2. cts. with hexagon nuts. Chicago: angle bars, 1.3 to 1.35 cts.; spikes, 1.6 to 1.7 cts.; track bolts, 1.9 to 2 cts., with hexagon nuts.

RAILS.—New York: $22 at eastern mills and $22.75 at tidewater; old rails, $11 to $11.50 for iron, and $10 for steel; steel rails fit for relaying, $14.00; light rails, $21; girder rails, $24. Pittsburg: $22 for standard sections of 45 lbs. and over; $23 for light sections; old rails, $12 for iron and $9 to $11 for steel. Chicago: $23 for standard sections; $25 for light sections; old rails, $10 to $11 for iron, and $6.50 to $9 for steel.

STRUCTURAL MATERIAL.—New York: beams, 1.3 to 1.5 cts.; channels, 1.35 to 1.5 cts.; angles, 1.2 to 1.35 cts.; tees, 1.4 to 1.6 cts.; universal mill plates, 1.2 to 1.35 cts.; steel plates, 1.25 to 1.4 cts. for tank, 1.4 to 1.45 cts. for shell, 1.5 to 1.65 cts. for flange, 1.75 to 2 cts. for ordinary firebox, 2 to 2.25 cts. for locomotive firebox. Pittsburg: beams, 1.2 to 1.25 cts.; channels, 1.2 to 1.25 cts.; angles, 1.05 to 1.15 cts.; tees, 1.2 to 1.25 cts.; universal mill plates, 1.05 to 1.15 cts.; steel plates, 1.15 to 1.25 cts. for tank, 1.3 to 1.35 cts. for shell, 1.35 to 1.4 cts. for flange, 2.5 to 3.75 for ordinary firebox, and 3.35 to 3.5 cts. for locomotive firebox. Chicago: beams, 1.4 to 1.45 cts.; channels, 1.4 to 1.45 cts.; angles, 1.3 to 1.35 cts.; tees, 1.65 to 1.7 cts.; universal plates, 1.3 to 1.35 cts.; steel plates, 1.35 to 1.4 cts. for tank, 1.5 to 2 cts. for flange, 2 to 4.5 cts. for firebox.

INDUSTRIAL NOTES.

THE OHIO FALLS CAR MFG. CO., of Jeffersonville, Ind., has an order for 1,000 box cars for the Pennsylvania R. R.

THE MARYLAND STEEL CO., of Sparrow's Point, Ind., has cast an ingot mold weighing 65,400 lbs. for the Midvale Steel Co., of Philadelphia, Pa.

THE PIERPONT BOILER CO., of Pittsburg, Pa., has an order for Pierpont water tube boilers of 1,500 HP. for the Ohio Steel Co., of Youngstown, O.

THE HOLLY MFG. CO., of Lockport, N. Y., has the contract for pumping engines of 5,000,000 gallons daily capacity for San Jose, Cal., and Topeka, Kan.

THE BALDWIN LOCOMOTIVE WORKS, of Philadelphia, Pa., have an order for 25 ten-wheel freight and 5 eight-wheel passenger engines for the Lehigh Valley R. R.

THE BERLIN IRON BRIDGE CO., of East Berlin, Conn., has the contract for a rolling and machine shop, 104 × 200 ft., for the Farrel Foundry & Machine Co., of Ansonia, Conn.

THE GRANITE MINERAL WOOL CO., 819 South Third St., St. Louis, Mo., is introducing its mineral wool for non-conducting purposes in buildings, cars, cold-storage plants, etc.

THE SULLIVAN MACHINERY CO., of Chicago, Ill., has added a department of mining supplies to its regular business in drills, quarrying machines, coal cutters and other machinery.

THE ASHTON VALVE CO., of Boston, Mass., has furnished 40 Ashton pop safety valves, 4½ ins. diameter, for the 8,500-HP. boiler plant of the Chicago & West Side Ry. Co.'s power house.

THE BASS FOUNDRY & MACHINE WORKS, of Fort Wayne, Ind., has shipped a 400-HP. Corliss engine, with cylinder 26 × 48 ins., to the Etna Standard Iron & Steel Co., of Bridgeport, O.

THE NATIONAL SEWER PIPE CO., of Barberton, O., held its annual meeting last week and elected officers as follows: Pres., O. C. Barber; Vice-Pres., Charles Baird; Treas., John B. Wright; Secy., E. M. Bull; Gen. Man., H. A. Robinson.

THE MOORE MFG. CO., of Buffalo, N. Y., informs us that Emmett Bros. & Co., of Buffalo, are using a Moore trench machine on their contract for a sewer in Ellicott St. The machine was described and illustrated in our issue of Dec. 6, 1894.

THE HICKS STOCK CAR CO., of Chicago, Ill., has had a receivership applied to its rolling-stock, on application of the Railroad Equipment Co. and the Terre Haute Car Mfg. Co. The company has about 3,000 cars leased to various railways, and also owns about 800 cars.

THE AMERICAN STEEL CASTING CO., of Thurlow, Pa., has cast a Spiller patent pneumatic depressing gun carriage, to be used in the turret of one of the new warships built at the Cramp shipyards in Philadelphia. It is 17 ft. 4 ins. diameter, and weighs 28,000 lbs.

THE ELLIOTT-WASHINGTON STEEL CO., of New Castle, Pa., has put up a new building 40 × 150 ft., and has added to its plant a Buckeye engine of 175 HP., a large annealing furnace and a rolling mill built by the Scaife Foundry & Machine Co., of Pittsburg, Pa.

THE CHICAGO SHIPBUILDING CO., of South Chicago, Ill., has a contract for a steel tow-barge with a capacity of 4,500 gross tons of iron ore. It will be 365 ft. long over all, 44 ft. beam and 26 ft. deep in the hold. Two steel steamers are also being built for the iron ore trade.

THE SPRAGUE ELECTRIC ELEVATOR CO., of New York city, has orders for 11 multiplying-sheave electric elevators and four tandem-drum electric elevators in the Parrott Building, San Francisco, Cal.; and also for electric elevators in the Custom House at New York and the Globe Building at Boston.

THE ROBINSON MACHINE CO., of Monongahela, Pa., has built an endless rope haulage plant for the Anchor mine at Brownsville, Pa. It consists of a pair of small engines connected by compound gearing with two grooved rope drums, the object of the compound gearing being to reduce the speed of the rope and to set a greater power from the small engines.

THE WHITLOCK COIL PIPE CO., of Elmwood, Conn., has purchased the plant and machinery of the Electric Pipe Bending Co., of Harrison, N. J., and to the large electric welding and pipe-bending plant thus acquired will add several of its hydraulic bending and coiling machines. The plant will have a daily capacity of 8,000 to 10,000 ft. of ⅛-in. to 4-in. pipe.

THE PENNSYLVANIA R. R. has had specifications prepared for large and powerful engines to haul heavy freight trains at high speed, and for the dressed meat and vegetable service. The engines are to run between Pittsburg and New York, and will be larger than the present class R. engines which are said to be the heaviest that it is considered desirable to use on the lines west of Pittsburg.

THE SCHENECTADY LOCOMOTIVE WORKS, of Schenectady, N. Y., are building 16 heavy engines for service on the mountain division of the Boston & Albany R. R. They have 69-in. driving wheels; cylinders, 20 × 24 ins.; boilers 5 ft. diameter, with 298 tubes and carrying 180 lbs. pressure. The tender tanks will carry 4,000 gallons of water. Sand jets operated by air pressure are placed in front of the driving wheels.

THE ASPHALTINA COMPANY OF AMERICA has been organized at Syracuse, N. Y., to manufacture an asphaltic composition for paving sidewalks and streets, covering roofs, etc., the material being the invention of John A. Just, of Syracuse. The composition may also be used for sewer pipes, electrical conduits, etc. Pres., Edward A. Powell; Vice-Pres., Daniel Candee; Secy. and Treas., D. W. Peck, 4 Clinton Block.

THE JOHNSON RAILROAD SIGNAL CO., of Rahway, N. J., has had Edward S. Savage appointed as its receiver, and by the terms of the order from the court the receiver was instructed to keep the works in operation. Mr. Savage announces that orders heretofore received will be filled without interruption or delay, and that all new orders received will be promptly attended to. He will be pleased to receive orders for material and to have an opportunity to bid on contemplated work.

THE BUCYRUS STEAM SHOVEL & DREDGE CO., of South Milwaukee, Wis., has received an order for one of its No. 0 special contractor's steam shovels from the Qualey Construction Co., for use on the Chicago drainage canal. This makes a total of 26 shovels made by this company now working on the canal. It is also getting out two large hydraulic dredges for the government, one to be used at Philadelphia and the other at Galveston, Tex.; one is to be a seagoing steamship with compound engines.

THE AULTMAN & TAYLOR MFG. CO., of Mansfield, O., is making a specialty of the Cahall vertical water tube boiler and has orders for the following: 250-HP. boiler, using blast furnace gas as fuel, for the Seneca furnaces at Leetonia, O.; 500-HP. for the Philadelphia Gas Co., at Kelly, Pa.; two boilers for the Solvay Process Co., of Syracuse, N. Y., and also boilers for a sugar refinery at Havana, Cuba. The orders were taken through H. E. Collins & Co., of Pittsburg, Pa., who are sales agents for the Cahall boilers.

THE PHILADELPHIA ROLL & MACHINE WORKS, of Philadelphia, Pa., announces that it has purchased from James Moore the entire plant of the Bush Hill Iron Works. David Townsend, who for 18 years has been associated with Mr. Moore and is a roll expert and rolling mill engineer, assumes the management of the works. Each department will be arranged for the most economical production of iron and steel works machinery, and a specialty will be made of the designing and turning of rolls for any section or service and the furnishing of plans and specifications for general engineering works.

COFRODE & SAYLOR, of Philadelphia, Pa., have applied for the discharge of the receivers in whose hands the company has been for about two years; and similar action has been taken in behalf of the Reading Rolling Mill Co., the two companies being closely related. One of the counsel for the receiver is reported as saying that after the legal formalities have been gone through the companies will once more start out to do business for themselves. The creditors have agreed to accept bonds, payable in installments from year to year, in payment of their claims, which removes any further need for receivers. The report of the receivers shows a satisfactory condition of finances, especially when the state of the money market is taken into consideraton.

THE NATIONAL SWITCH & SIGNAL CO., of Easton, Pa., has a contract for putting up a signal plant at East Boston, Mass. This plant is to operate and control the new terminals at that point of the Boston, Revere Beach & Lynn R. R., and will be a 40-lever machine with torpedoes, electric slots, light indicators and all the latest improvements. The company has also been awarded the contract for putting in a system of signals at Catlettsburg, Ky., for the Chesapeake & Ohio Ry., crossing an electric line. The apparatus furnished for this crossing is unique and provides that the levers shall be operated by the conductor of the motor car, and that he cannot leave the signal tower until he has left all the levers in the position in which he found them upon entering the tower.

THE GENERAL ELECTRIC CO., of Schenectady, N. Y., has the contract for a three-phase electric power transmitting plant for the cotton mills of the Pelzer Mfg. Co., of Pelzer, S. C. At the generating station, three miles from the mills, there will be three slow-speed generators of 750 KW. each, directly coupled to water wheels. These dynamos will generate current at a potential of 3,300 volts, and the current will be fed directly to the transmission wires at this pressure. The transmission line will consist of 18 No. 00 wires. At one mill will be a 400-HP. synchronous motor, receiving current directly from the wires. There will also be more than 20 motors in various rooms; 14 of these will be of 110 HP. each, and the others will be of various sizes, from 5 to 75 HP. In a sub-station will be located nine 160-KW. transformers for the motors and for 1,200 incandescent lights for the mills.

THE COMMERCIAL DEPARTMENT OF THE IMPERIAL GERMAN CONSULATE, 120 East Randolph St., Chicago, Ill., has been established to stimulate commercial exchange between the United States and Germany and to facilitate the intercourse between buyers and sellers of merchandise of all kinds (raw material, manufactures, machinery, apparatus and instruments); to keep both sides posted on the subjects of duties, currency, rules for importation and exportation, etc., and to give information about new inventions, patents, new processes of manufacture, etc. Its work is limited to collecting and distributing information, commercial and technical, and all such information is given free of charge. It is not an agency for a certain number of private firms, and it does not undertake to close business transactions of any kind, nor will it interfere with any business relations already existing between firms of both countries. It had its origin with the Columbian Exposition, after the close of which the establishment of such a bureau proved to be a necessity, in order that the Consulate might be enabled to attend to the many inquiries received.

NEW COMPANIES.—Hyde Park National Gas Co., Leechburg, Pa.; $25,000, commencing with $2,500; Treas., Dr. J. D. Orr.

Steel Storage & Elevator Co., Connersville, Ind.; $100,000; E. D. Johnson.

Phillipsburg Iron Works, Phillipsburg, Mont.; $45,000; foundry and general iron work.

Gould Roofing Co., Cleveland, O.; $50,000; Lee H. Gould, E. R. Merrill and Isaac Reynolds.

John W. Mills Co., Chicago, Ill.; $10,000; hot air apparatus; John W. Mills and Fred. Dilzer.

Artesian Stone & Lime Works, Chicago, Ill.; $60,000; Thomas O'Connell and Andrew J. O'Connell.

National Stock Car Co., Chicago, Ill.; $600,000; Wm. W. Smith, Robt. L. Green and L. H. Green.

Everson Tube & Metal Co., Pittsburg, Pa.; George H. Everson, Joseph A. Shinn and John Owen.

San Antonio Pressed Brick Co., San Antonio, Tex.; $50,000; J. Leonhardt, G. Glorda and J. W. Day.

Jeffersonville Corrugating & Roofing Co., Jeffersonville, Ind.; $10,000; Patrick C. Donovan and others.

Girard Water Wheel Co., San Francisco, Cal.; $100,000; Lake Battles, W. A. Leonard and A. H. Winn.

Grand Crossing Tunnelling Co., Chicago, Ill.; $1,000; Parke E. Simmons, G. C. Murray and E. Rutishauser.

Holmes Steam Shovel Co., Danville, Ill.; $50,000; Robert Holmes, Frank Penwell and John Vreedenburg.

Rhodes Metallic Piston Rod Packing Co., Fort Worth, Tex.; $5,000; John Rhodes, L. M. Hatchell and E. Otto.

Morgan Ave. Improvement Co., Chicago, Ill.; $100,000; James A. Mahon, H. M Elliott and O. K. Hutchinson.

Chicago Great Western Coal & Mining Co., Chicago, Ill.; $500,000; Edward W. Russell and Lawrence Browne.

Daniels Antiseptic & Fumigating Co., Chicago, Ill.; $150,000; John A. Mason, G. A. Kimball and D. W. Perkins.

Spearman Iron Co., Sharpsville, Pa.; $300,000, commencing with $30,000; Treas., John G. Spearman, Sharon, Pa.

Standard Supply Co., Des Moines, Ia.; $5,000; windmills and pumps; J. C. Carter, H. D. Reeve and R. W. Crocker.

Lyman Water Circulating & Heating Co., Chicago, Ill.; $500,000; Thomas W. Lyman, J. C. Williams and W. H. Storms.

Milwaukee Frog Blocking Co., Milwaukee, Wis.; railway supplies; C. W. Briggs, A. D. Watson and Lawrence Wood.

Model Wire Fence Foundry & Planing Mill Co., East St. Louis, Ill.; $150,000; John C. Fullenwelder, Henry Miller and W. H. Bennett.

Pneumatic Refrigerating Co., Newark, N. J.; $200,000, commencing with $1,000; Geo. H. Abrams, Brooklyn, N. Y.; Samuel Hatt, New York city.

Massachusetts Car Co., Saco, Me.; $300,000; cars and railway supplies; Pres., G. A. Hilton, Milton, Mass.; Treas., W. G. Wheildon, Stoneham, Mass.

Machinery Contracting Co., Chicago, Ill.; $25,000; to deal in contractors' machinery and plant; Wm. H. Finney, James H. Boyle and Ellis S. Chasbrough.

United States Car Brake Co., Boston, Mass.; $5,000,000, commencing with $1,500; C. M. Carpenter, Brookline, Mass.; Henry Waterman, Boston, Mass.; D. D. Gill, Melrose, Mass.

United States & Haiti Cable Co., New York, N. Y.; $2,500,000, commencing with $10,000; J. W. Mackay, Virginia City, Nev.; G. G. Ward, Brooklyn, N. Y.; Albert Beck, New York city.

Standard Mfg. Co., Jersey City, N. J.; commencing with $1,000; street railway appliances; John C. Bowles and Josiah A. Webber, of Brooklyn, N. Y.; H. W. Douty, of Asbury Park, N. J.

Hampson Flexible Steam Joint Co., Lakeport, N. H.; $35,000, all paid in; steam hose couplings; Pres., John S. Crane; Treas., B. F. Drake. General Manager, F. A. Barbey, 152 Federal St., Boston.